Check List the journal of biodiversity data
ANNOTATED LIST OF SPECIES

A collection and analysis of amphibians and reptiles from Nicaragua with new country and departmental records

José Gabriel Martínez-Fonseca[1], Iris A. Holmes[2, 3], Javier Sunyer[4], Erin P. Westeen[5], Maggie R. Grundler[5], Peter A. Cerda[3], Maynor A. Fernández-Mena[6], Julio C. Loza-Molina[6], Ivan V. Monagan, Jr.[7], Daniel Nondorf [8], Gregory G. Pandelis[9], Alison R. Davis Rabosky[3]

1 *School of Forestry, Northern Arizona University, Flagstaff, Arizona, USA*
2 *Cornell Institute of Host Microbe Interactions and Disease and Department of Microbiology, Cornell University, Ithaca, New York, USA*
3 *Museum of Zoology and Department of Ecology and Evolutionary Biology, University of Michigan, Ann Arbor, Michigan, USA*
4 *Associate Researcher, Museo Herpetológico de la Universidad Nacional Autónoma de Nicaragua – León, León, Nicaragua*
5 *Department of Environmental Science, Policy, and Management and Museum of Vertebrate Zoology, University of California, Berkeley, California, USA*
6 *Ministerio de Ambiente y Recursos Naturales, Managua, Nicaragua*
7 *Department of Ecology, Evolution, and Environmental Biology, Columbia University and American Museum of Natural History, New York, USA*
8 *Department of Biology, University of Virginia, Charlottesville, Virginia, USA*
9 *Amphibian and Reptile Diversity Research Center, Department of Biology, University of Texas at Arlington, Arlington, Texas, USA*

Corresponding author: *José Gabriel Martínez-Fonseca (jm3934@nau.edu)*

Abstract. Nicaragua is a biodiverse country, but documented herpetological specimens are underrepresented compared to neighboring countries. In 2018 we conducted a collaborative expedition between the University of Michigan Museum of Zoology and Nicaraguan biologists. We visited sites in the Pacific Lowlands, Caribbean Lowlands, and the Central Highlands, representing the three major biogeographic regions of Nicaragua. We collected specimens of 100 species from a total of 106 encountered. We provide accession numbers and morphological, genetic, and ecological information for these specimens. We recorded 23 new departmental records and the first country record of *Metlapilcoatlus indomitus* (Smith & Ferrari-Castro, 2008), filling gaps in the known distribution of the species within Nicaragua and across Central America. When available for each species, we provide range maps and comparative genetic trees including conspecific reference sequences from the region, making this work a significant addition to existing checklists of the herpetofauna in Nicaragua.

Key words. Barcode, biogeography, Central America, herpetofauna, Mogotón, museum collections, Refugio Bartola

Martínez-Fonseca JG, Holmes IA, Sunyer J, Westeen EP, Grundler MR, Cerda PA, Fernández-Mena MA, Loza-Molina JC, Monagan IV Jr., Nondorf D, Pandelis GG, Rabosky ARD (2024) A collection and analysis of amphibians and reptiles from Nicaragua with new country and departmental records. Check List 20 (1): 58–125. https://doi.org/10.15560/20.1.58

INTRODUCTION

Central America is a globally important biodiversity hotspot, and Nicaragua plays a key biogeographic role in the region (Gutiérrez-García and Vázquez-Domínguez 2013). Nicaragua lies in the center of the continent, where northern and southern flora and fauna meet, resulting in a unique species profile (Sunyer and Köhler 2010; Sunyer 2014). Repeated marine inundations of this area formed a barrier to dispersal that disappeared only 3.1–2.7 Ma. Specifically, this region has been shown to represent the northern or southern range limits of many Central American herpetofauna (Savage 2002; Marshall 2007). Such recent interchange of ancient evolutionary lineages situates Nicaragua as a globally important region for research in fields such as biogeography, community ecology, and population genetics.

The last published checklist of the herpetofauna of Nicaragua listed 248 species, of which 74 are amphibians and 174 are reptiles (Sunyer 2014). This represents the lowest biodiversity of amphibian and reptile taxa of Central American countries that border both the Pacific Ocean and the Caribbean Sea (Incer 1973; Köhler 2008; Sunyer 2014). This relatively low diversity can be attributed to the country's smoother topography, which does not promote altitude-driven isolation processes (Savage 2002; Marshall 2007; Köhler 2008). However, civil unrest from the 1970s to the 1990s stalled research, and therefore biodiversity of the country has been underestimated. Since the 2000s, biodiversity research in the country has slowly recovered, increasing the number of known species of amphibians and reptiles (Köhler et al. 2013;

OPEN ACCESS

Academic editor: Manuella Folly
Received: 28 July 2023
Accepted: 22 December 2023
Published: 18 January 2024

Salazar-Saavedra et al. 2015; Fernández et al. 2017; Loza et al. 2017; Martínez-Fonseca et al. 2019a), mammals (Medina-Fitoria et al. 2010, 2015; Loza et al. 2018; Martínez-Fonseca et al. 2018), and birds (Múnera-Roldán et al. 2007; Chavarría-Duriaux et al. 2018). All these studies highlight the need for more comprehensive surveys in different regions of the country that can help improve the estimates of species richness and distribution. In addition, Nicaragua has one of the highest deforestation rates in the world, including a 20% decrease in forest cover in the last 20 years (Hansen et al. 2013). The rate of habitat destruction increases the urgency of conducting biodiversity surveys in Nicaragua.

Biogeographically, Nicaragua is divided into three main regions (Figure 1). The Pacific Lowlands in the west are dominated by a young, active volcanic chain and tectonic uplifting, with depressions filled by the two largest freshwater lakes in the region; the Caribbean Lowlands in the east are dominated by sedimentary soils that slowly drain into Caribbean Sea; and the Central Highlands which reach 2,100 m near the border with Honduras. The Central Highlands are part of the nuclear Central American formation that links with the lower Sierra Madre in southern Mexico (Vinson and Brineman 1963; Incer 1973; MARENA 1999; Sunyer and Köhler 2010).

Species richness of amphibians and reptiles in these regions somewhat matches the degree of historical anthropogenic disturbance (Sunyer 2009). The Caribbean Lowlands has the highest species richness and the greatest area of native forest. This diversity decreases to the west where rains are more seasonal and where human settlements and habitat degradation are greater (Sunyer 2009). Nicaragua has 13 endemic species of herpetofauna, of which seven are amphibians and six reptiles (Sunyer 2014; HerpetoNica 2015). The Caribbean Lowlands and islands in this region host seven species restricted to the Corn Islands and higher isolated elevations of the Saslaya National Park (HerpetoNica 2015). Both the Pacific Lowlands and the Caribbean Highlands have three endemics each, also restricted to isolated peaks above 800 m of elevation (HerpetoNica 2015).

Scientific collecting expeditions, during which biological specimens are captured, preserved, and later deposited into natural history museums along with associated data, remain the best way for scientists to understand the processes that generate and maintain biodiversity (Holmes et al. 2016). Such expeditions can produce vast amounts of data for each specimen, including but not limited to providing material for genetic analysis, morphological, ecological, behavioral, distribution, and climatic data, all of which can be garnered from a single specimen (Rabosky et al. 2019; May et al. 2019). Furthermore, specimens represent snapshots in time and can be used to infer climatic and habitat changes (DuBay and Fuldner 2017) and how those changes have influenced species distributions through time (Weeks et al. 2020).

From May to June of 2018, we conducted an expedition in partnership with the University of Michigan

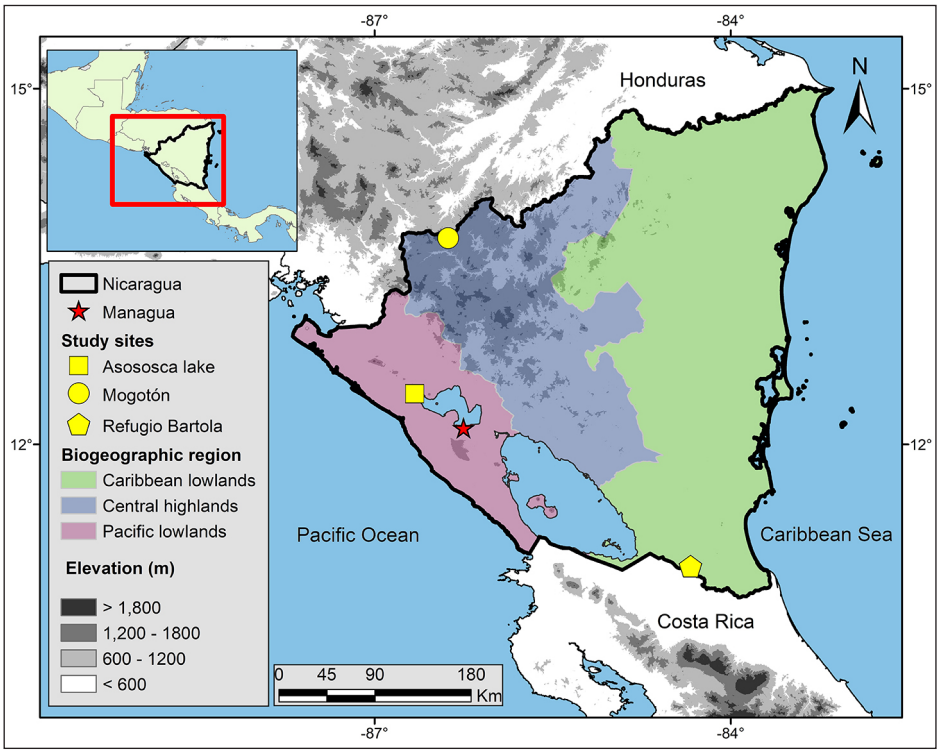

Figure 1. Map of the three main collecting sites in the three main biogeographic regions of Nicaragua: Caribbean Lowlands, Central Highlands, and Pacific Lowlands. From north to south: Las Brisas del Mogotón in Nueva Segovia department; Asososca Lake in León department; Refugio Bartola in Rio San Juan department. Inset map corresponds to the extent of the main map in Central America.

Museum of Zoology to survey and collect amphibian and reptile species across Nicaragua's northern, central, and southern regions. We chose our survey locations to maximize habitat and taxonomic diversity by visiting different vegetation formations. Vegetation formations chosen for surveys were informed by Sunyer (2009) which states that over two-thirds of the species occur in lowland wet and moist forest, with close to a third occurring in Lower Montane Moist Forest. We visited lowland dry forest to include the most distinct vegetation of the Pacific of the country. Our field expedition was part of the ongoing effort to continue increasing our knowledge of herpetological diversity and distributions in Nicaragua. Fieldwork also provides opportunities to collaborate with colleagues from different regions, countries, and nations, each with unique perspectives and knowledge systems. Collaborative, reciprocal science is often more productive, beneficial to all parties, and can result in higher quality science (Golden et al. 2014; Linn et al. 2017; Ramírez-Castañeda et al. 2022). By combining resources between the UMMZ and Nicaraguan herpetologists, we were able to complete a highly successful herpetological expedition.

STUDY AREA

We worked in three locations, one for each of the main biogeographic regions. We wanted to increase the representation of species from Nicaragua in museum collections, so we aimed to visit as many different vegetation formations as possible. These locations spanned Nicaragua's diverse landscape, including six out of the nine forest formations in the country (Figure 2; Holdridge 1967). In addition to choosing one site in each of the bioregions of Nicaragua, our final selection had to consider landowner permissions and logistics to host all members of the expedition and collect specimens. Our first site was Las Brisas del Mogotón (also known as Mogotón; 13.7402, −086.379), near the border with Honduras in the Serranía Dipilto-Jalapa Natural Reserve in the Central Highlands (Incer 1973; Marshall 2007). We sampled three distinct habitats with different biotic communities along an altitudinal gradient. At lower elevations (<600 m), we sampled Lowland Arid Forest, characterized by <1000mm of total annual precipitation and deciduous vegetation. At intermediate elevation (600–1200 m) we encountered Premontane Moist Forest with annual precipitation ~2000 mm, dominated by upland oak-pine forest (Incer 1975). The highest elevations (1200–2100 m) represent Lower Montane Moist Forest with high annual precipitation (>2000mm), less seasonality, and the lowest mean temperatures in the country.

Our second site, Asososca Lake-Momotombo (also known locally as "Laguna del Tigre"; 12.4272, −086.6613), is one of the many volcanic lakes in the Pacific Lowlands in the Department of León (elev. 100 m). Lowland dry forests (<600 m) are the main vegetation formation (Incer 1975; Marshall 2007). Annual precipitation in this region is one of the lowest in the country with 1000–2000 mm in two well-defined seasons. Lowland dry forest is the most endangered habitat of the American continent, with less than two percent of the original extent remaining (Portillo-Quintero and Sánchez-Azofeifa 2010). The forest is composed of mostly small, but occasionally larger, deciduous trees.

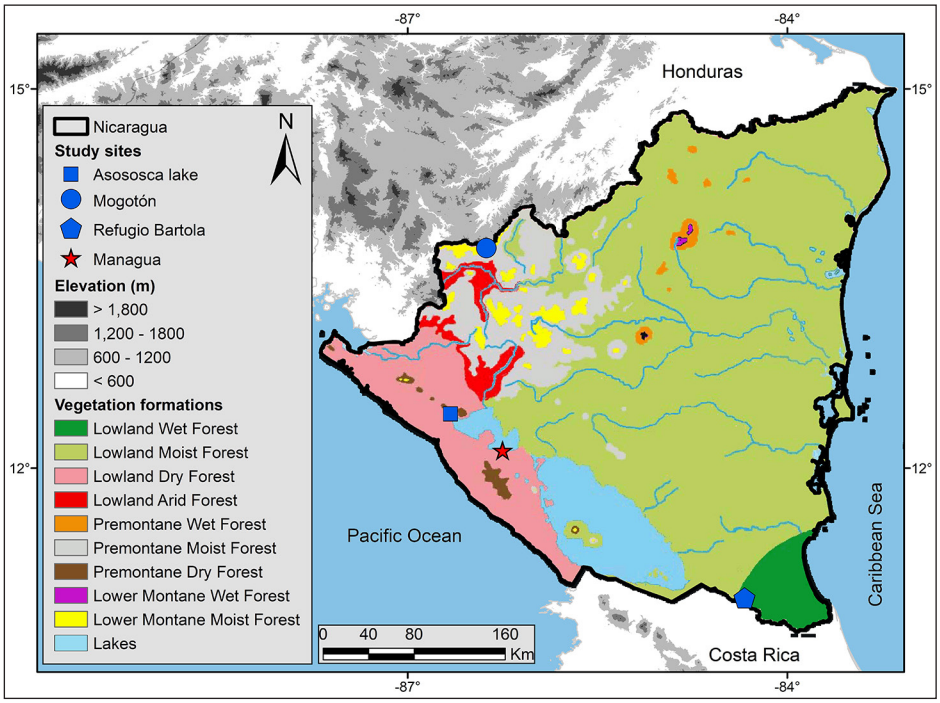

Figure 2. Main vegetation formation patterns within Nicaragua based on Holdrige (1967) and modified by Sunyer (2009).

Finally, we sampled in the Río San Juan department, part of the Caribbean Lowland bioregion in southeastern Nicaragua near the border with Costa Rica. Refugio Bartola (also known as Bartola) is one of over 70 private reserves in Nicaragua and the herpetologically richest locality in the country (Sunyer and Pierson 2015). Bartola sits at the confluence of the Río Bartola and the Río San Juan (10.9776, −084.3337); the latter is a prominent component of the "Nicaraguan depression", a belt of low elevation land that stretches from the Caribbean to the Pacific, forming a biogeographic barrier for many species in the region (Savage 2002; Marshall 2007). Our site was in a transition zone of the Caribbean slope at about 60 m elevation, between the lowland moist forest with an annual precipitation of 2000–4000 mm and the even wetter lowland wet forest (>4000 mm). We additionally sampled a variety of riparian areas and small streams. This site is recognized as one of the most biologically diverse of the country (Sunyer 2009; Sunyer et al. 2009).

METHODS

Work was conducted under research permits by the national authority Ministerio de Ambiente y Recursos Naturales (MARENA) No. DGPNB-IC-025-2018. Sample and specimen exports No. DGPNB-IC-019-2018, DGPNB-IC-029-2018, DGPNB-IC-002-2019. We did not collect species listed by the Convention on International Trade in Endangered Species (CITES) in Nicaragua, but we list the species encountered and provide photographs of uncollected individuals.

In the field, we collected a set of morphological, ecological, and behavioral metadata associated with each specimen. Specifically, we collected basic morphometric data (snout–vent length, mass, and tail length where applicable), geographic coordinates of the capture location were recorded using a GPS receiver using the WGS84 datum, and standardized ecological and behavioral observations made at the specimens' point of capture when possible. We include all additional morphometric data as supplemental material. Our ecological data include macrohabitat type (such as upland forest or riparian habitat), the substrate on which the animal was resting at the time of encounter (such as ground, leaf, trunk, or branch), perch height and diameter, and a description of the behavior of the animal at the time of encounter. We included this information in the remarks section of the species accounts.

When possible, we sequenced a section of the 16S rRNA barcode gene from our specimens (Vences et al. 2012). We chose this gene because of the large amount of comparative material available in public databases. When conspecific genetic sequences from two or more Central American countries were available in GenBank from the National Center for Biotechnology Information, we showed a gene tree to visualize regional genetic clusters in the species account. In addition, we used the sequences from our specimens to confirm or exclude our morphology-based species identifications when comparative sequences were available. We aligned the sequences, with the addition of a congeneric or confamilial outgroup, using the program Muscle through its online portal (Edgar 2004), then built a tree in RAxML with 1000 bootstraps (Stamatakis 2014). To display these data, we color-coded GenBank reference sequences by country of origin, in addition to displaying their GenBank accession numbers and country of origin as tip labels on our gene tree. We coded sequences from our sampling sites in Nicaragua by listing collection location and collection ID as tip labels on the tree. We stress that our single-gene trees built from a few sequences are not definitive representations of the phylogeographic history of the species.

We present range maps for each species, including both the locations in which we captured the species, and records of vouchered specimens from Honduras, El Salvador, Nicaragua, and Costa Rica available in the Global Biodiversity Information Facility (GBIF). Data from GBIF was acquired by defining the search based on: "Species = XXXX", "Basis of record = Preserved specimens", "Location = Including coordinates" and "Country or Area = Guatemala; Honduras; El Salvador; Nicaragua; Costa Rica." We restricted the search to include records of physical specimens with exact coordinates to reduce the chances of including imprecise records. We paired these point localities with an expert assessment-based range polygon from the International Union for the Conservation of Nature (IUCN) Red List assessments, which are available for most species we discuss. While these two data sources do not represent the totality of knowledge on a species, they do reflect relative sampling effort in different countries and locations and are widely used options for large-scale biodiversity analyses. We provide this as a quick reference for future researchers and allow identify areas of interest or underrepresented in collections. For new departmental and country records we conducted a literature search and cited the relevant sources within the corresponding species accounts.

Sunyer (2014) provided the latest checklist of the reptiles and amphibians of Nicaragua. However, Sunyer's publication is only a list and therefore does not include photographs, descriptions of habitat, details of the species, maps, or gene trees; the information presented in this annotated list of species represents a significant volume of new data not presented in traditional checklists. Further, we include three species that were not included by Sunyer (2014): *Rhinobothryum bovallii*, *Scaphiodontophis annulatus*, and *Metlapilcoatlus indomitus*. Here, our species accounts include 1) a photograph of the live specimen, 2) materials examined with museum and field tag numbers, 3) GenBank accession numbers, 4) short description of our specimens that matches diagnostic characteristics for identification based primarily on

the publications of Köhler (2001, 2008, 2011), Savage (2002), Cisneros-Heredia and Mcdiarmid (2007); McCranie (2011, 2018), 5) comments on distribution.

We organize our species accounts taxonomically by order, and within orders alphabetically by family. In the Appendix we provide range maps that show a) a gray polygon showing the expert-opinion based IUCN range estimate (where available), b) museum-quality collection record points, and c) localities in which we collected the species.

RESULTS

We encountered 106 species of amphibians and reptiles. We collected specimens of 100 of these species and observed an additional six species that we did not collect due to limitations of our permits. We encountered the highest species richness at Refugio Bartola (65), followed by Las Brisas del Mogotón (35) and Laguna de Asososca-Momotombo (21). We provide detailed information on the respective species accounts below.

Order Anura
Family Aromobatidae

***Allobates talamancae* (Cope, 1875)**
Figure 3A; Appendix Figure A1

New record. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9776, −084.3337; 8.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 20:20; SVL 21 mm; 0.66 g; UMMZ 247022 (RAB3229).

Identification. Savage (2002) described this species as small and well camouflaged but once it has been located, it is easily recognized by two pairs of light lines (four in total) from the eye to the tailbone on a mostly black to dark brown body with a white ventral surface. This is the only species in its genus to occur in Central American wet forests (Savage 2002; Köhler 2011).

Remarks. This individual was found active during the day in the leaf litter. This species was by far the least common dendrobatid found in Refugio Bartola during our expedition.

Family Bufonidae

***Incilius coniferus* (Cope, 1862)**
Figure 3B; Appendix Figure A2

New records. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9714, −084.3360; 1.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 19:40; SVL 34 mm; 2.32 g; UMMZ 247004 (RAB3114); GenBank OM801092 • Same locality; 1.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 21:14; SVL 68 mm; 18.5 g; UMMZ 247005 (RAB3131); 18.5 g; 1.VI.2018; GenBank OM801104.

Identification. Both individuals were medium-sized toads, distinguished from other *Incilius* species by having small parotid glands which are less than half the size of the upper eyelid (Savage 2002; Köhler 2011). The species has slender limbs relative to other bufonids. Finger II is longer than finger I (Savage 2002). Coloration is variable, but green is most common.

Remarks. Our 16S tree is not well-resolved, but it shows Nicaraguan and Costa Rican samples as early branches, while the sequences from Panama cluster in a strongly supported group. This species is semi-arboreal and can be found at night perching on vegetation up to 2 m above ground in wet and moist environments (Savage 2002; Köhler 2011; HerpetoNica 2015).

***Incilius luetkenii* (Boulenger, 1891)**
Figure 3C; Appendix Figure A3

New records. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.7402, −086.379; 21.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 89 mm; 45.25 g; UMMZ 247008 (RAB3044); GenBank OM801032 • Same locality; 13.6839, −086.3661; 23.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 95 mm; 54.3 g; UMMZ 247009 (RAB3054); GenBank OM801040. – **Dept. León** • Asososca Lake; 12.4272, −086.6613; 27.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 74 mm; 28.71 g; UMMZ 247010 (RAB3095); GenBank OM801075 • Same locality; 28.V.2018; 21:30; SVL 84 mm; 36.9 g; UMMZ 247011 (RAB3105); GenBank OM801083.

Identification. Males can be easily identified by a uniform yellow coloration and white underparts. Most females are light brown. This species has parotid glands about the half of the size of the upper eyelid and well-defined cranial crests (Savage 2002; Köhler 2011).

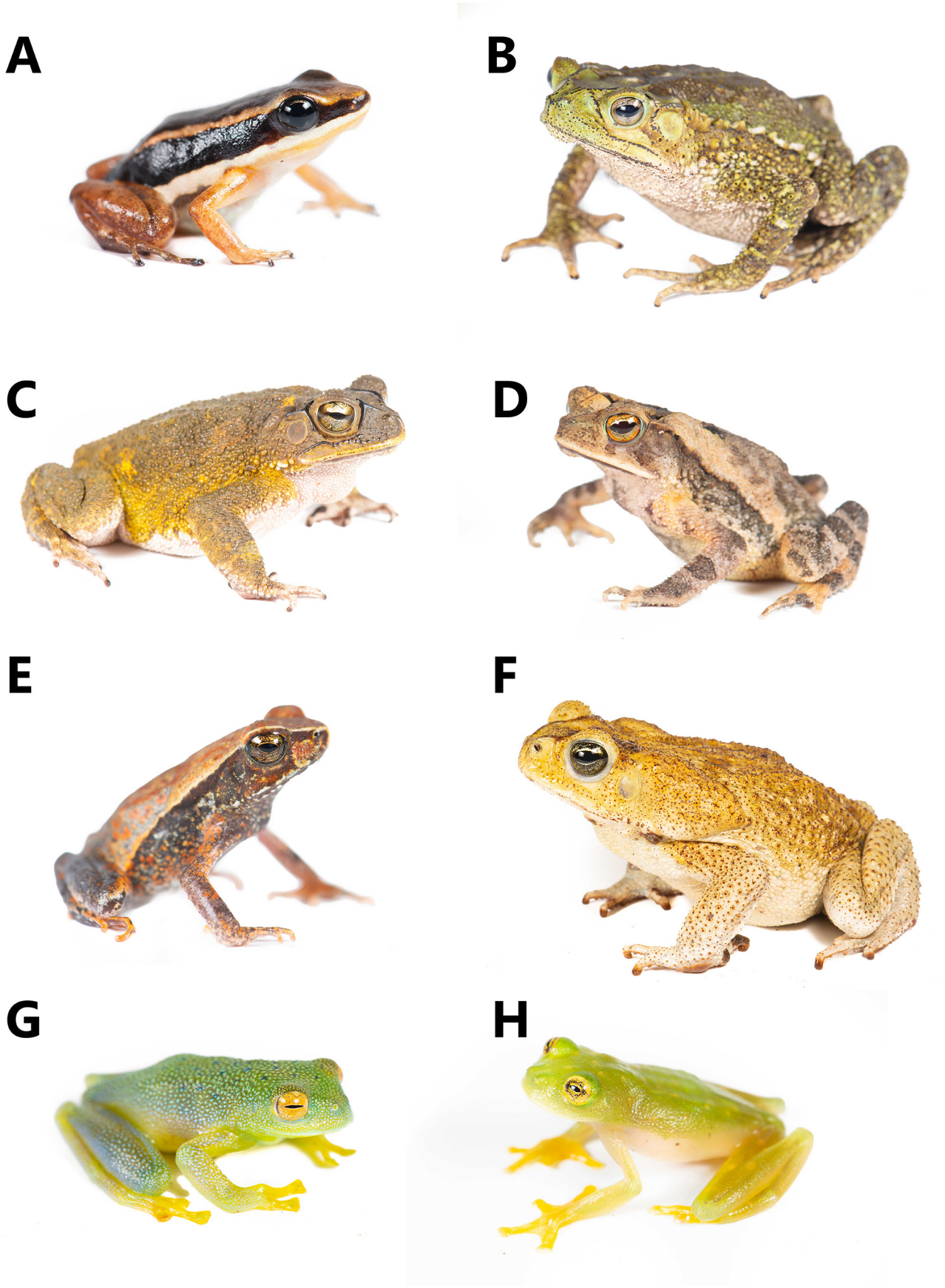

Figure 3. Species encountered during the 2018 UMMZ expedition to Nicaragua. **A.** *Allobates talamancae*, UMMZ 247022. **B.** *Incilius coniferus*,UMMZ 247005. **C.** *Incilius luetkenii*, UMMZ 247008. **D.** *Incilius valliceps*, UMMZ 247015. **E.** *Rhaebo haematiticus*, UMMZ 247006. **F.** *Rhinella horribilis*, UMMZ 247012. **G.** *Cochranella granulosa*, UMMZ 247019. **H.** *Hyalinobatrachium fleischmanni*, UMMZ 247020.

Remarks. This species was very abundant in the low elevation areas we visited including the foothills of Mogotón. They were actively calling in ponds or shore of the Asososca Lake matching the beginning of the rainy season in the country.

Distribution. Our record from Mogotón is the first for the Department of Nueva Segovia (Köhler 2001; Sunyer et al. 2014b).

***Incilius valliceps* (Wiegmann, 1833)**
Figure 3D; Appendix Figure A4

New record. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9706, −084.33242; 4.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 10:05; SVL 60 mm; 12.5 g; UMMZ 247015 (RAB3170); GenBank OM801135.

Identification. This is a medium-sized species with distinct cranial crests. Our individual can be identified by the elliptical parotid glands which are equal to or larger than the upper eyelid, and by their dark throat (Savage 2002, Köhler 2011).

Remarks. This species can be found mostly in wet forests but has also been recorded in dry forests from sea level to 2000 m (Martínez-Fonseca et al. 2015, Klank et al. 2020). Our 16S tree showed that our sample represents an outgroup to a cluster of weakly differentiated sequences from Honduras, Guatemala, and Belize. Samples from Mexico form a well-supported sister clade to the more southerly samples.

***Rhaebo haematiticus* (Cope, 1862)**
Figure 3E; Appendix Figure A5

New records. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9708, −084.3353; 3.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 09:40; SVL 27 mm; 1 g; UMMZ 247006 (RAB3166); GenBank OM801132 • Same locality; 9.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 15:44; SVL 25 mm; 0.98 g; UMMZ 247007 (RAB3237); GenBank OM801190.

Identification. In Nicaragua, HerpetoNica (2015) described the species as unmistakable with contrasting dorsolateral lines (running from snout to tailbones) and smooth, reddish-brown skin with no cranial crests. All our individuals matched these descriptions. This is the only species of the genus to occur in the country (Savage 2002; Köhler 2011; HerpetoNica 2015).

Remarks. This is a distinctive small to medium-sized species primarily found in wet forests and often associated with riparian areas. Our 16S tree indicates that our samples are genetically distant from other available Central American sequences. In another study, samples from Ecuador had similarly idiosyncratic relationships to complex genetic structures within Panamanian samples (Ron et al. 2015), which the authors took to indicate cryptic diversity in the lineage.

***Rhinella horribilis* (Wiegmann, 1833)**
Figure 3F; Appendix Figure A6

New records. NICARAGUA – **Dept. León** • Asososca Lake; 12.4281, −086.66129; 27.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 20:10; SVL 119 mm; 111.5 g; UMMZ 247012 (RAB3089); GenBank OM801070 • Same locality; 12.4290, −086.6630; 27.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 20:12; SVL 118 mm; 103.1 g; UMMZ 247013 (RAB 3096); GenBank OM801076 – **Dept. Rio San Juan** • Refugio Bartola; 10.9776, −084.3337; 3.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 66; 18.6 g; UMMZ 247014 (RAB3171).

Identification. Our specimens were unmistakable due to their large size, tuberculated skin, and very large parotid glands several times the size of the upper eyelids. Coloration ranges from bright yellow to brown (Köhler 2001; Savage 2002; HerpetoNica 2015).

Remarks. This medium-sized to large toad is one of the most common amphibian species in Nicaragua (HerpetoNica 2015). Our 16S tree showed that our samples cluster with Costa Rican and Honduran sequences, while more northern animals formed a separate group. However, the support for the nodes is very low, indicating a poorly resolved tree.

Family Centrolenidae

***Cochranella granulosa* (Taylor, 1949)**
Figure 3G; Appendix Figure A7

New records. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9741, −084.3392; 7.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 27; 1.07 g; UMMZ 247018 (RAB 3218); GenBank

OM801174 • Same locality; 7.VI. 2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 27 mm; 0.97 g; UMMZ 247019 (RAB3219); GenBank OM801175.

Identification. Both individuals were recognized as belonging to this species by being small frogs with blue-green dorsal coloration with scattered dark spots, a snout that is flat and rounded in profile, dark green bones, and a white stripe on the upper lip. Skin on dorsum of both individuals was strongly granular, which is also distinctive of this species among other centrolenids known to occur in Nicaragua (Savage 2002; Köhler 2011).

***Hyalinobatrachium fleischmanni* (Boettger, 1893)**

Figure 3H; Appendix Figure A8

New records. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9776, −084.3337; 7.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 25 mm; 0.7 g; UMMZ 247020 (RAB3221); GenBank OM801177 • Same locality; 10.9741, −084.3392; 7.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 26 mm; 0.57g; UMMZ 247021 (RAB3222); GenBank OM801178.

Identification. Both individuals were pale green frogs with yellow spots on their dorsal surface, forward-directed eyes, and white bones (as opposed to the dark green bones of *C. granulosa* or light green bones in *Teratohyla pulverata*). The tympanum in both individuals was indistinct and nostrils had tiny fleshy swellings which is a diagnostic feature for this species (Savage 2002; Köhler 2011).

Distribution. Both of our individuals are the first records of this species in the Department of Rio San Juan (Köhler 2001; Sunyer et al. 2009, 2014b).

***Sachatamia albomaculata* (Taylor, 1949)**

Figure 4A; Appendix Figure A9

New records. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9741, −084.3392; 7.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 25 mm; 0.77 g; UMMZ 247016 (RAB3220); GenBank OM801176 • Same locality; 7.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 24 mm; 0.74 g; UMMZ 247017 (RAB3223); GenBank OM801179.

Identification. Our specimens were blue-green frogs that can be distinguished from other glass frog species in Nicaragua by their shortened white sheath over the internal organs compared to other glass frogs, white stripe on the upper lip, and no white pigment on digestive tract (Savage 2002; Köhler 2011).

***Teratohyla pulverata* (Peters, 1873)**

Figure 4B; Appendix Figure A10

New records. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9776, −084.3337; 4.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 18 mm; 0.48 g; around 21:00; UMMZ 247023 (RAB 3183); GenBank OM801146 • Same locality; 4.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 20 mm; 0.46 g; around 21:00; UMMZ 247024 (RAB3184); GenBank OM801147 • Same locality; 10.9735, −084.3300; 5.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 21 mm; 0.47 g; 21:45; UMMZ 247025 (RAB3198).

Identification. All our specimens a had lime-green dorsum with numerous small yellow spots, a rounded snout which is flattened in profile, and light green bones which are diagnostic (Köhler 2001; Savage 2002).

Family Craugastoridae

***Craugastor bransfordii* (Cope, 1886)**

Figure 4C; Appendix Figure A11

New records. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9699, −084.3339; 3.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 22:06; SVL 23 mm; 1.06 g; UMMZ 247045 (RAB3165); GenBank OM801131 • Same locality; 10.9725, −084.3389; 5.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 19:46; SVL 26 mm; 1.25 g; UMMZ 247047 (RAB3202); GenBank OM801162.

Identification. Both of our specimens were small brown frogs with reddish coloration on their hindquarters. They can be identified as belonging to this species by the large tubercles on the bottom of their feet and webbing present at the base of toes II–IV. The tubercles at the base of the thumb are not larger than the tubercles on the palm of the hand (Savage 2002; Köhler 2011).

Remarks. Our 16S gene tree indicates that the Nicaraguan specimens are nested within a Costa Rican clade, which are in turn nested inside the Panamanian sequences.

***Craugastor fitzingeri* (Schmidt, 1857)**

Figure 4D; Appendix Figure A12

New records. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9776, −084.3337; 1.VI.2018; ; DN,

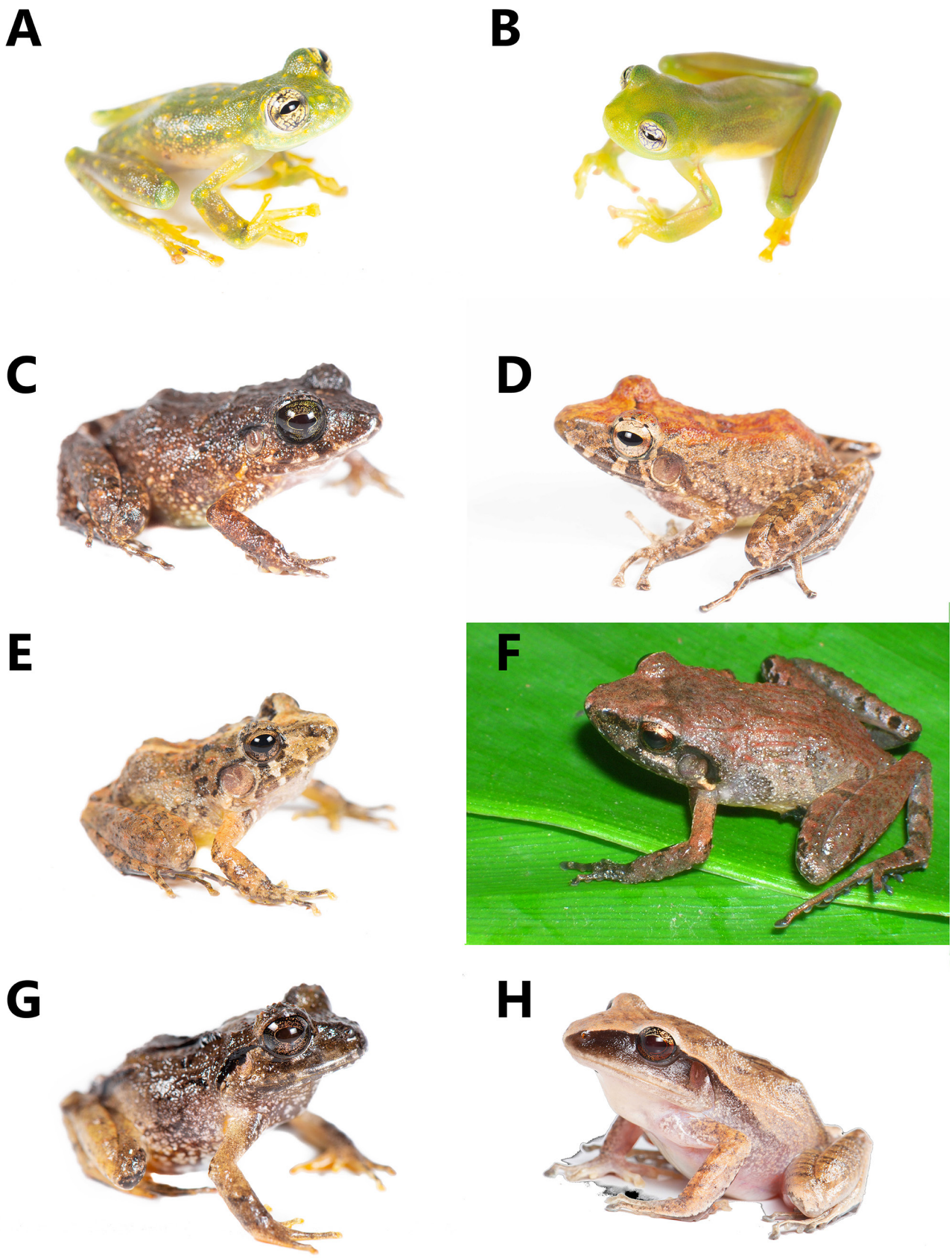

Figure 4. Species encountered during the 2018 UMMZ expedition to Nicaragua. **A.** *Sachatamia albomaculata*, UMMZ 247016. **B.** *Teratohyla pulverata*, uncollected specimen. **C.** *Craugastor bransfordii*, UMMZ 247047. **D.** *Craugastor fitzingeri*, UMMZ 247062. **E.** *Craugastor laevissimus*, uncollected specimen from Las Brisas del Mogotón. **F.** *Craugastor lauraster*, photo of an individual from Saslaya National Park; photo J. Sunyer. **G.** *Craugastor megacephalus*, UMMZ 247057. **H.** *Craugastor noblei*, UMMZ 247058.

EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 19:03; SVL 23 mm; 1.47g; UMMZ 247062 (RAB3116); OM801094 • Same locality; 10.9729, −084.3360; 1.VI.2018; ; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 21:16; SVL 32 mm; 2 g; UMMZ 247063 (RAB 3123); GenBank OM801099 • Same locality; 10.9715, −084.3343; 1.VI.2018; ; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 20:16; SVL 30 mm; 1.8 g; UMMZ 247064 (RAB3128); GenBank OM801102 • Same locality; 10.9776, −084.3337; 2.VI.2018; ; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 8.26 mm; 4.7 g; UMMZ 247067 (RAB3154); GenBank OM801125 • Same locality; 4.VI.2018; 10.9728, −084.3390; SVL 32 mm; 1.87 g; UMMZ 247061 (RAB3182); GenBank OM801145.

Identification. All our individuals were small, brown frogs that can be distinguished from other *Craugastor* species by the slight toe webbing and a pale chin with dark speckles, with an un-speckled line along the center and running from the nose toward the vent. Fingers II–IV were broadly expanded, and thighs possess mottling and clear spots (Savage 2002; Köhler 2011).

Remarks. This species is highly polymorphic, and we observed many individuals with and without the clear light-colored dorsal line.

***Craugastor laevissimus* (Werner, 1896)**
Figure 4E; Appendix Figure A13

New records. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.7449, −086.3789; 17.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 20:50; SVL 31 mm; 2.9 g; UMMZ 247044 (RAB3030); GenBank OM801018 • Same locality; 13.7453, −086.3840; 25.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 18:49; SVL 24 mm; 1.49 g; UMMZ 247052 (RAB3073); GenBank OM801056.

Identification. Both of our individuals were small brown frogs that can be distinguished from other similar species by warty dorsal skin, smooth ventral skin, and a light dorsolateral stripe (Hedges et al. 2008; Köhler 2011).

Distribution. Both of our individuals are the first records of the species in the Department of Nueva Segovia (Köhler 2001; Sunyer et al. 2014b).

***Craugastor lauraster* (Savage, McCranie & Espinal, 1996)**
Figure 4F; Appendix Figure A14

New records. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.7452, −086.3788; 17.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 20:55; SVL 21 mm; 0.62 g; UMMZ 247053 (RAB3032); GenBank OM801020 • Same locality; 13.7408, −086.3795; 17.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 18:31; SVL 21 mm; 0.91 g; UMMZ 247054 (RAB3034); GenBank OM801022 • Same locality; 13.7402, −086.379; 25.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; around 17:00; SVL 21 mm; 0.77 g; UMMZ 247055 (RAB3077); GenBank OM801059.

Identification. Our individuals were small, brown frogs that can be distinguished from similar species by their black eye mask and banded rear legs. They also presented a distinct inner tarsal fold (Savage 2002).

Remarks. Our 16S tree is poorly supported, with the Mogotón samples clustering within Honduran and Nicaraguan samples.

***Craugastor megacephalus* (Cope, 1875)**
Figure 4G; Appendix Figure A15

New records. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9776, −084.3337; 5.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 24 mm; 0.97 g; UMMZ 247056 (RAB3196); GenBank OM801158 • Same locality; 10.9782, −084.3343; 5.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 20:35; SVL 22 mm; 0.72 g; UMMZ 247057 (RAB3201); GenBank OM801161.

Identification. Both individuals were medium-sized brown frogs that can be distinguished from related *Craugastor* species by their very large head and its paired cranial crests. Their venters show a dark brown reticulated pattern (Savage 2002; Köhler 2011).

***Craugastor noblei* (Barbour & Dunn, 1921)**
Figure 4H; Appendix Figure A16

New records. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9706, −084.3342; 4.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 19:51; SVL 70 mm; 16.5 g; UMMZ 247058 (RAB3185); GenBank OM801148 • Same locality; 10.9776, −084.3337; 8.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 20:31; SVL 58 mm; 8.55 g; UMMZ 247059 (RAB3231); GenBank OM801186.

Identification. Both individuals were distinguished from similar species by the webs that extend along the

base of their toes, larger toe disks on outer fingers compared to inner fingers, and a long eye mask that starts on the nose and continues onto its flanks. Both individuals also had a glandular supratympanic ridge extending over a third of the body length (Savage 2002; Köhler 2011).

***Pristimantis cerasinus* (Cope, 1875)**
Figure 5A; Appendix Figure A17

New records. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9776, −084.3337; 2.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 22 mm; 0.7 g; UMMZ 247048 (RAB3148); GenBank OM801120 • Same locality; 10.9742, −084.3369; 3.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 23mm; 0.72 g; 19:42; UMMZ 247066 (RAB 3172); GenBank OM801136 • Same locality; 10.9708, −084.33244; 4.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 26 mm; 0.87 g; 20:50; UMMZ 247046 (RAB3186); GenBank OM801149.

Identification. All our individuals were small, light brown frogs with distinctive darker W-shaped dorsal markings, dark bars on the limbs, and toes without webs. They also have large, pointed tubercles on the heel, and the fifth toe does not reach the last tubercle on the bottom of the toe four. All of these characteristics are diagnostic of this species (Savage 2002; McCranie and Wilson 2003).

Remarks. In contrast to other eleutherodactylid and craugastorid species we sampled, our *P. cerasinus* samples showed strong genetic differentiation from all available sequences from the species. Bartola *P. cerasinus* had 5% genetic differentiation from both *P. cerasinus* and *P. cruentus* sequences. However, the Bartola specimens nested within Costa Rica and Panama sequences. In the 16S tree, the Panamanian *P. cruentus* sequence (FJ784498) is sister to all *P. cerasinus* samples.

***Pristimantis ridens* (Cope, 1866)**
Figure 5B; Appendix Figure A18

New record. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9736, −084.33531; 1.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 21:05; SVL 29 mm; 1.1 g; UMMZ 247060 (RAB3129); GenBank OM801103.

Identification. Our specimen can be distinguished from similar species by its pointed snout tip, pointed tubercles above the eyes, no W-shaped mark on dorsum, and lack of heel tubercles (Savage 2002).

Remarks. Our 16S gene tree shows that the Bartola specimen shares more genetic similarity to conspecifics from Honduras despite being geographically closer to Costa Rica. The Costa Rica, Nicaragua, and Honduras specimens in turn form a geographical cluster that is distinct from the Panamanian *P. ridens*. The strong separation of the Panama *P. ridens* in our data is a key similarity with a much broader study of *P. ridens* phylogeography that used a different mitochondrial gene (Wang et al. 2008). That study lacked samples from Nicaragua but showed that Honduran *P. ridens* were genetically similar to Costa Rican frogs. Wang et al. hypothesized that this species occupied higher-elevation habitats across Central America for over 10 million years, then expanded into lowland wet forest habitats more recently. More extensive sampling in eastern Nicaragua might demonstrate whether there is continuous geographical connectivity between the known southern Nicaraguan and northern Nicaraguan/Honduras populations.

Family Dendrobatidae

***Dendrobates auratus* (Girard, 1855)**
Figure 5C

New record. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9736, −084.33531; 1.VI.2018; JGMF, IAH, EPW, MRG, MAFM, JCLM, IVM, DN, GGP obs.; we encountered several individuals actively moving during early hours of the morning; not collected.

Identification. We observed several individuals, clearly diagnosed by their metallic-green dorsum and venter with black or dark brown, irregular blotches or bands. This is the only species in the genus that occurs in Nicaragua (Savage 2002; Köhler 2011; HerpetoNica 2015).

Remarks. We did not collect this species due to CITES restrictions in our permits. The photo is from an individual captured and released in Refugio Bartola.

***Oophaga pumilio* (Schmidt, 1857)**
Figure 5D

New record. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9736, −084.33531; 1.VI.2018; JGMF, IAH, EPW, MRG, MAFM, JCLM, IVM, DN, GGP obs.; we encountered several individuals actively moving during early hours of the morning; not collected.

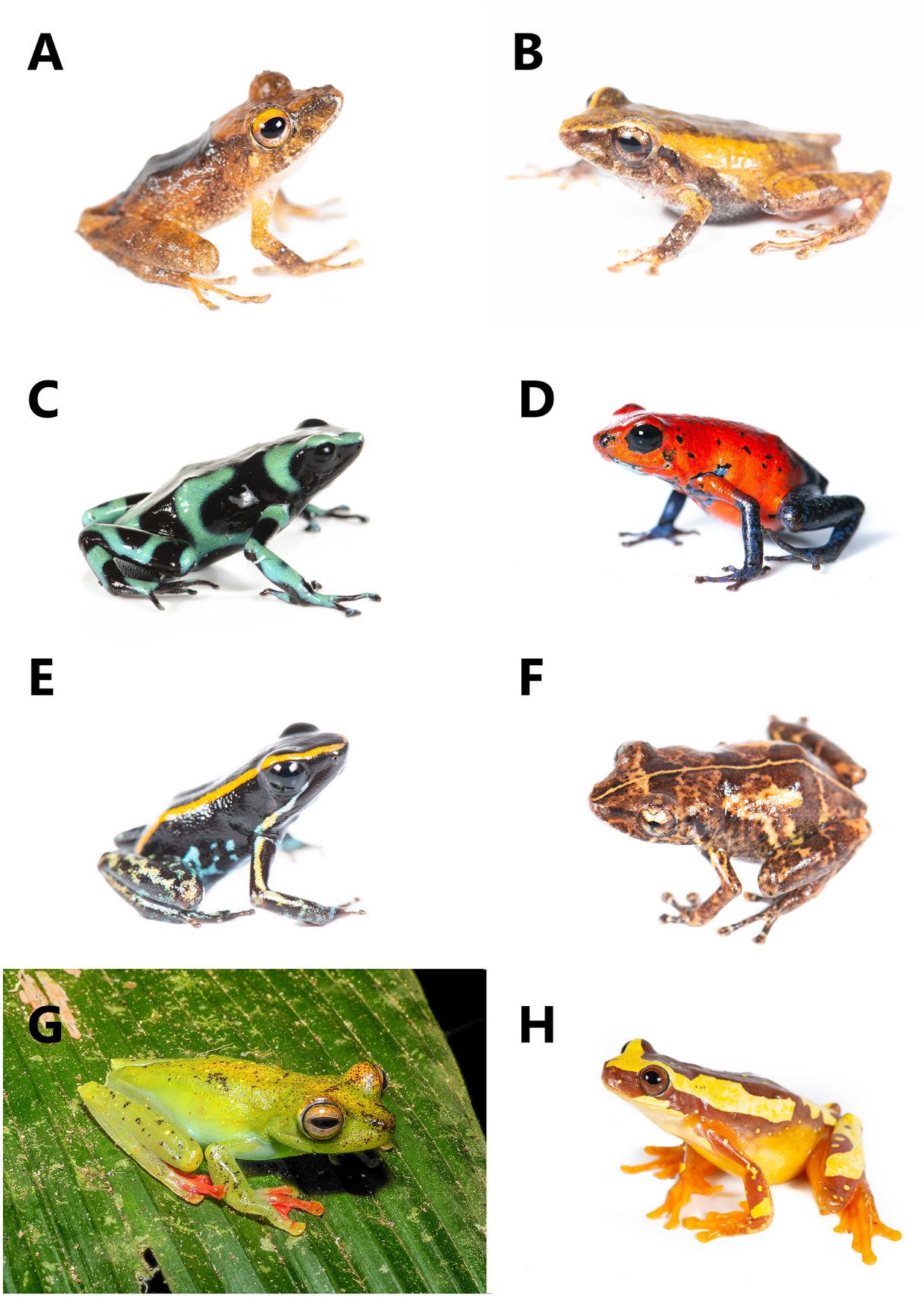

Figure 5. Species encountered during the 2018 UMMZ expedition to Nicaragua. **A.** *Pristimantis cerasinus*, UMMZ 247048. **B.** *Pristimantis ridens*, UMMZ 247060. **C.** *Dendrobates auratus*, uncollected specimen from Refugio Bartola. **D.** Oophaga pumilio, uncollected specimen from Refugio Bartola. **E.** *Phyllobates lugubris*, uncollected specimen from Refugio Bartola. **F.** *Diasporus diastema*, UMMZ 247065. **G.** Boana rufitela, UMMZ 247028. **H.** *Dendropsophus ebraccatus*, UMMZ 247026.

Identification. While the species can be highly variable in coloration, populations in southern Nicaragua are easily distinguished by their relatively small size (SVL <17 mm) and mostly bright red body with blue or dark-blue hind legs (Köhler 2001; HerpetoNica 2015).

Remarks. We observed many individuals of this species at Refugio Bartola. We did not collect this species due to CITES restrictions in our permits. The photo is from an individual captured and released in Refugio Bartola.

***Phyllobates lugubris* (Schmidt, 1857)**
Figure 5E

New record. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9736, −084.33531; 3.VI.2018; JGMF, IAH, EPW, MRG, MAFM, JCLM, IVM, DN, GGP obs.; we encountered one individual actively moving 08:00 and finding refuge among dead organic material in the roots of a big *Ficus* tree; not collected.

Identification. We encountered a single individual of this species. It was easily identifiable as belonging to this species by their mostly black body with contrasting yellow dorsolateral stripes that bordered the upper eyelids. The upper surfaces of limbs were faintly marbled with golden speckles (Köhler 2011).

Remarks. We did not collect this species due to CITES restrictions in our permits. The photo is from the individual captured and released in Refugio Bartola.

Family Eleutherodactylidae

***Diasporus diastema* (Cope, 1875)**
Figure 5F; Appendix Figure A19

New records. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9712, −084.3352; 1.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 19:55; SVL 21 mm; 0.61 g; UMMZ 247065 (RAB 3113); GenBank OM801091 • Same locality; 1.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 19:02; SVL 17 mm; 0.38 g; UMMZ 247049 (RAB 3115); GenBank OM801093 • Same locality; 1.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 18:59; SVL 21 mm; 0.7 g; UMMZ 247050 (RAB3121); GenBank OM801097 • Same locality; 10.9769, −084.3384; 3.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 22:07; SVL 23 mm; 0.71 g; UMMZ 247051 (RAB3174); GenBank OM801137.

Identification. All individuals were grey to brown frogs that can be identified by their uniformly pigmented thighs, lack of webbing on feet, and finger II and III with palmate disc covers and broadened disc pads (Köhler 2011). Our individuals had very smooth skin both dorsally and ventrally, while some highland populations include individuals with large tubercles across the dorsal surface (Sunyer 2009; McCranie et al. 2019).

Remarks. This species was found in abundance in Refugio Bartola. Our 16S tree failed to find well-supported differentiation between Costa Rican and Nicaraguan samples. The taxonomy of this species is complex, and some or all Nicaraguan populations may be better described as *Diasporus chica* (Cope, 1875). In the absence of comparative genetic material for *D. chica*, we are unable to place our samples with respect to this taxonomy.

Family Hylidae

***Boana rufitela* (Fouquette, 1961)**
Figure 5G; Appendix Figure A20

New record. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9721, −0843335; 4.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 21:30 resting on a leaf two meters above the ground in upland forest; SVL 57 mm; 7.3 g; UMMZ 247028 (RAB3181); GenBank OM801144.

Identification. We encountered one individual of this relatively rare species easily distinguishable by its green coloration with red interdigital membrane. Eyes were twice the size of the tympanic membrane, and the specimen lacked an axillar membrane (Savage 2002; Köhler 2011).

***Dendropsophus ebraccatus* (Cope, 1874)**
Figure 5H; Appendix Figure A21

New records. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9728, −084.3390; 5.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 23:00; SVL 35mm; 2.35 g; UMMZ 247026 (RAB3200); GenBank OM801160 • Same locality; 9.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 20:27; SVL 37 mm; 2.53 g; UMMZ 247027 (RAB3236); GenBank OM801189.

Identification. This is a distinctive species with large yellow or white patches on the back and limbs. Our individual also had a well-developed axillar membrane and an interdigital membrane that extends halfway

up the fingers of the hand and 75% the length of the toes, which are characteristic of this species (Savage 2002; Köhler 2011).

***Ptychohyla hypomykter* McCranie and Wilson, 1993**
Figure 6A; Appendix Figure A22

New records. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.7505, −086.3767; 21.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 20:27; SVL 42 mm; 4.89 g; UMMZ 247029 (RAB3047) • Same locality; 13.7548, −086.3771; 21.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 18:38; SVL 36 mm; 1.36 g; UMMZ 247030 (RAB 3048); GenBank OM801035 • Same locality; 13.7402, −086.379; 25.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 35 mm; 2.31 g; UMMZ 247031 (RAB3075).

Identification. Our individuals were easily identifiable as belonging to this species by having a rounded snout, bronze eyes, and interdigital membrane a third of the length of the fingers in the hands and 90% of the length of the toes. The color was variable, but the most common pattern is brown with light brown dorsal patches and immaculate white ventral surface (McCranie and Wilson 1993; Köhler 2011).

***Scinax elaeochroa* (Cope, 1875)**
Figure 6B; Appendix Figure A23

New record. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9776, −084.3337; 3.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 38 mm; 2.79 g; UMMZ 247032 (RAB3169) • Same locality; 8.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 33.5 mm; 1.72 g; UMMZ 247033 (RAB3234); GenBank OM801188.

Identification. Both individuals were easily identified by the green bones which can be seen through the ventral surface of the limbs. Dorsal coloration quickly changed from green to brown after capture. No interdigital membrane is present in the hands, and the disk of the third finger is larger than the tympanic membrane. There are no markings on thighs. This species can be distinguished from the glass frogs by its opaque dorsal skin (Savage 2002; Köhler 2011).

***Smilisca baudinii* (Duméril & Bibron, 1841)**
Figure 6C; Appendix Figure A24

New records. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.7414, −086.3786; 17.V.2018; 19:30; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 59 mm; 11.52 g; UMMZ 247037 (RAB3031); GenBank OM801019 • Same locality; 13.7404, −086.3805; 17.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 18:20; SVL 68 mm; 21.2 g; UMMZ 247038 (RAB3033); GenBank OM801021 • Same locality; 13.7402, −086.379; 21.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 50 mm; 5.75 g; UMMZ 247034 (RAB3045); GenBank OM801033 • Same locality; 21.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 59 mm; 8.15 g; UMMZ 247035 (RAB3046); GenBank OM801034.

Identification. Our individuals were distinguished from other *Smilisca* species by presenting a much thinner trans-ocular strip (reaching across the back of the head between the eyes), and clear markings on the lips and thighs (Savage 2002).

Remarks. This is common medium-sized frog, very variable in coloration and the only member of the genus that inhabits the lowland dry forests of Nicaragua (McDiarmid et al. 1987). This species can hibernate in desiccation-proof cocoons (McDiarmid et al. 1987). The 16S samples for this species are included in the *S. manisorum* tree and discussed in the following section. Note that the reference records and IUCN polygons on the maps for *S. baudinii* and *S. manisorum* correspond to the former species.

***Smilisca manisorum* (Taylor, 1954)**
Appendix Figure A25

New record. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9776, −084.3337; 2.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 60 mm; 14.4 g; UMMZ 247036 (RAB3147); GenBank OM801119.

Identification. This species was recently separated from *S. baudinii*. McCranie (2017) suggested that *S. baudinii* is a species complex, with the previously synonymized species *Smilisca* [*Hyla*] *manisorum* occupying lowland eastern Honduras, Nicaragua, and Costa Rica. Our individual of *S. manisorum* can be distinguished from *S. baudinii* by the locality but also its larger adult size, greater amount of toe webbing, and flatter metatarsal tubercle (McCranie 2017).

Remarks. We only collected one specimen (UMMZ 247036) that matched the description for this newly separated species. The precise distributions of *S. baudinii* and *S. manisorum* are uncertain, but they

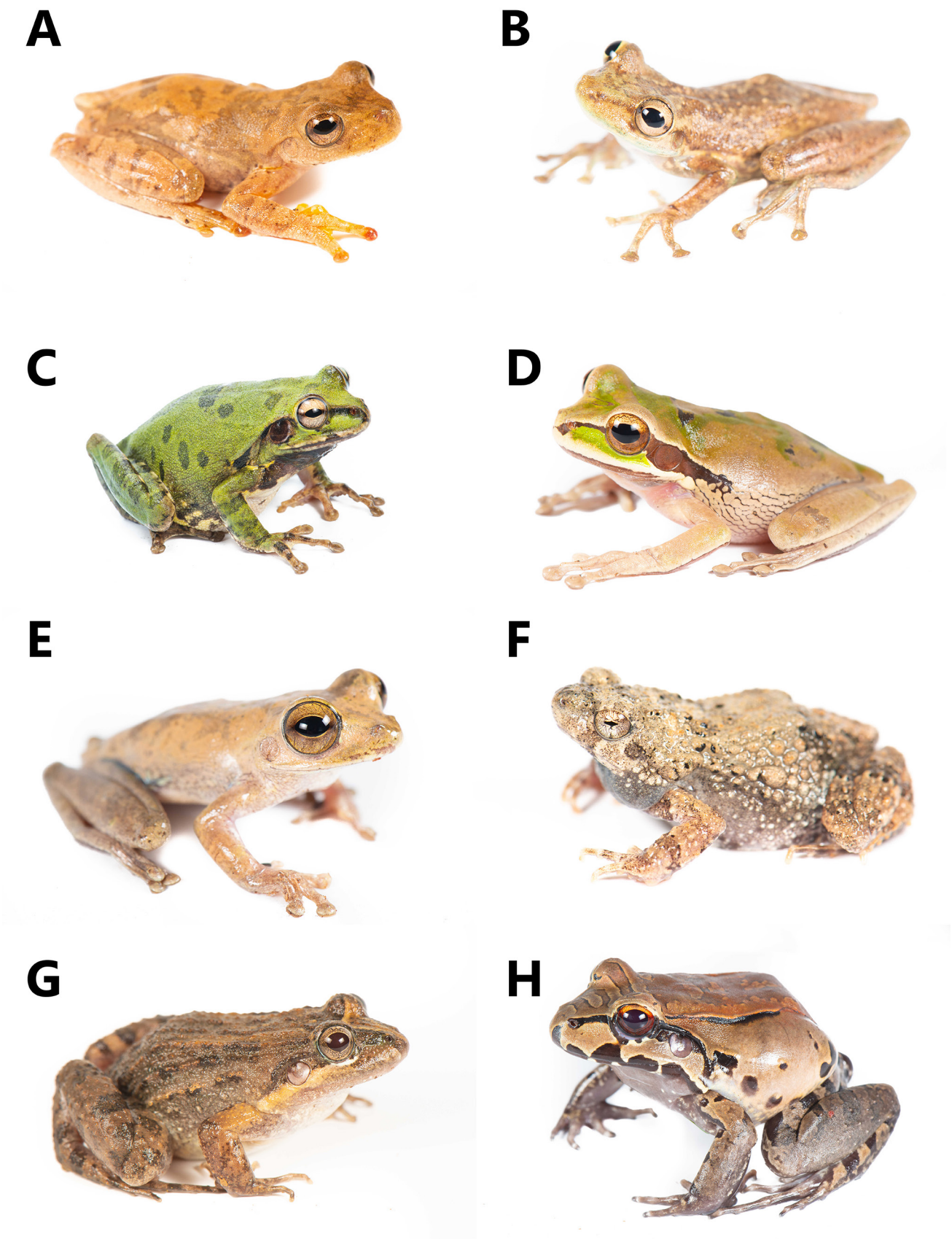

Figure 6. Species encountered during the 2018 UMMZ expedition to Nicaragua. **A.** *Ptychohyla hypomykter*, UMMZ 247031. **B.** *Scinax elaeochroa*, UMMZ 247032. **C.** *Smilisca baudinii*, uncollected specimen. **D.** *Smilisca phaeota*, UMMZ 247040. **E.** Smilisca sordida, UMMZ 247042. **F.** *Engystomops pustulosus*, UMMZ 247072. **G.** *Leptodactylus melanonotus*, UMMZ 247070. **H.** *Leptodactylus savagei*, UMMZ 248385.

seem to appear in Nicaragua along a east–west gradient. Our Mogotón samples, UMMZ 247037, 247038, and 247034-247035, most likely belong to *S. baudinii*, while our Bartola sample would be assigned to *S. manisorum*. Further morphological and genetic work could confirm this proposed taxonomic division and resolve the phylogeographic history of this widespread taxon. Our 16S tree shows a strong separation between our Mogotón and Bartola *S. baudinii*–*S. manisorum* samples, with the Bartola sample clustering with the Costa Rican samples as predicted by the McCranie species complex hypothesis. Note that the reference records and IUCN polygons on the maps for *S. baudinii* and *S. manisorum* correspond to the former.

***Smilisca phaeota* (Cope, 1862)**
Figure 6D; Appendix Figure A26

New records. NICARAGUA – **Dept. León** • Puerto Momotombo; 12.38251, −086.62734; 28.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 22:30; SVL 74 mm; 25.9 g; UMMZ 247039 (RAB3104) – **Dept. Rio San Juan** • Refugio Bartola; 10.9712, −084.3352; 1.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 19:51; SVL 46 mm; 4.54 g; UMMZ 247040 (RAB3122); GenBank OM801098 • Same locality; 10.9776, −084.3337; 2.VI.2018; SVL 46 mm; 4.08 g; UMMZ 247041 (RAB3150); GenBank OM801122.

Identification. Our individuals were identified by the trans-ocular dark strip that covers the tympanum and fades away right after the axilla into a reticulated pattern of large, unevenly shaped spots. All our individuals have a green patch under the eye and immaculate upper lip (Savage 2002; Köhler 2011).

Remarks. This is a relatively common medium-sized arboreal frog. Our 16S tree shows samples from Costa Rica and Peru nested within the Nicaraguan samples.

***Smilisca sordida* (Peters, 1863)**
Figure 6E; Appendix Figure A27

New records. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9725, −084.3315; 2.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 21:15; SVL 42 mm; 2.78 g; UMMZ 247042 (RAB3149); GenBank OM801121 • Same locality; 2.VI.2018; 21:09; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 56 mm; 10.3 g; UMMZ 247043 (RAB3151).

Identification. Our specimens of this medium-sized species can be identified by an inter-ocular dark band connecting both eyes at the top of the head. It lacks an axillar membrane. The tympanic membrane is separated from the eye by a distance equal to two-thirds of the diameter of the membrane. The webbing on the hands extends further than in other *Smilisca* in Nicaragua (Köhler 2011).

Family Leptodactylidae

***Engystomops pustulosus* (Cope, 1864)**
Figure 6F; Appendix Figure A28

New records. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.70534, −086.36174; 22.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 21:00; SVL 29 mm; 1.55 g; UMMZ 247072 (RAB3066); GenBank OM801051 – **Dept. León** • Asososca Lake; 12.4283, −086.6610; 26.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 26 mm; 1.16 g; UMMZ 247073 (RAB 3088); GenBank OM801069.

Identification. This is an easily identifiable and relatively small species. Our individuals were recognized by the tuberculated tympanic membrane and warty dorsal skin. The first finger is longer than the second, and toes have small fringes. A clear white line is often present from the chin to the throat and ventral surface has multiple spots (Nascimento et al. 2005; Köhler 2011).

Remarks. In Costa Rica, *E. pustulosus* is represented by two ecologically distinct lineages: a southern group that occurs in wet forest, and a northern group that inhabits dry forest. Both geography and habitat indicate that our samples belong to the dry-forest group, but further sampling and genetic work on the specimens from western Nicaragua and Costa Rica could confirm that association (Pröhl et al. 2010). The 16S sequence from the sample clusters in a poorly resolved group with another Nicaragua sample and a Costa Rican sample.

***Leptodactylus melanonotus* (Hallowell, 1861)**
Figure 6G; Appendix Figure A29

New records. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.70534, −086.3617; 22.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 21:00; SVL 38 mm; 4.28 g; UMMZ 247069 (RAB3067); GenBank OM801052 – **Dept. León** • Asososca Lake; 12.4305, −086.6602; 27.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 21:15; SVL 44 mm; 5.43 g; UMMZ 247070 (RAB3090); GenBank OM801071.

Identification. Both individuals of this species were recognizable by a tuberculated dark dorsal surface, a smooth, mostly white belly, and the lack of strong dorsolateral folds. Males have nuptial claws made of darkened, rough skin on thumbs but lack pectoral nuptial pads. The tympanic membrane is 50–70% the size of the eye. An orange or yellow band on the lips extends to the shoulders (Savage 2002; Köhler 2011; Sá et al. 2014).

***Leptodactylus savagei* Heyer, 2005**
Figure 6H; Appendix Figure A30

New records. NICARAGUA – Dept. Rio San Juan • Refugio Bartola; 10.9666, −084.3334; 2.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 20:15; SVL 116 mm; 100 g; UMMZ 247071 (RAB3153); GenBank OM801124 • Same locality; 10.9678, −084.3359; 2.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 19:45; SVL 148 mm; 250 g; UMMZ 248385 (RAB3155); GenBank OM801126.

Identification. Our individuals were easily identifiable as belonging to this species, of one of the largest amphibians in Nicaragua, by their overall size, large eyes that produce a strong eyeshine when illuminated by headlamps, and an almost circular snout with a barred or spotted upper lip. A dark line through the eye that bends towards the shoulder and a pair of dorsolateral folds are also characteristic of this species (Köhler 2011; Sá et al. 2014; McCranie et al. 2019).

Remarks. The species is mostly nocturnal and terrestrial, with semifossorial behavior, and both of our individuals were found near burrows. While being photographed, UMMZ 248385 displayed a "high stand" defensive behavior.

Family Phyllomedusidae

***Agalychnis callidryas* (Cope, 1862)**
Figure 7A

New record. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.7451, −086.3788; 17.V.2018; JGMF, IAH, EPW, MRG, MAFM, JCLM, IVM, DN, GGP obs.; around 20:00; found in vegetation over a small stream in a pine-oak forest; not collected.

Identification. We encountered one individual of this species, easily recognizable by the green color, red eyes, blue and yellow bands on its sides, and reticulated lower eyelid (Köhler 2011).

Remarks. We did not collect this species due to CITES restrictions in our permits. The photo is of an individual captured and released in Las Brisas del Mogotón.

Family Ranidae

***Lithobates forreri* (Boulenger, 1883)**
Figure 7B; Appendix Figure A31

New record. NICARAGUA – **Dept. León** • Asososca Lake; 12.4300, −086.6606; 27.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 21:00; SVL 65 mm; 21.04 g; UMMZ 247074 (RAB3094); GenBank 801074.

Identification. We encountered one individual with the characteristic well-developed dorsolateral fold of skin running from the eye to the base of the hind limb. It had >15 dark brownish spots evident on the dorsal surface. The hind limbs had dark bands (Grismer 2002).

Remarks. Our individual was found on a small pond, as is usual for this species. This species might represent a species complex (Luque-Montes et al. 2018; McCranie et al. 2019). The 16S tree groups our sample with a sequence from Honduras.

***Lithobates maculatus* (Brocchi, 1877)**
Figure 7C; Appendix Figure A32

New records. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.7451, −086.3788; 17.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 20:50; SVL 80 mm; 38.3 g; UMMZ 247075 (RAB3024); GenBank OM801036 • Same locality; 13.7406, −086.3785; 21.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 18:21; SVL 57 mm; 14.07 g; UMMZ 247076 (RAB3049); GenBank OM801036.

Identification. Both of our specimens had a tympanum smaller than the eye, a single metatarsal tubercle on the hind foot, dorsolateral folds with a black border, and a black face mask which is typical of this species (Hillis and Sá 1988). They also lacked clear dark blotches on the dorsum, but blotches were present on the flanks, as usual in this species (Köhler 2011).

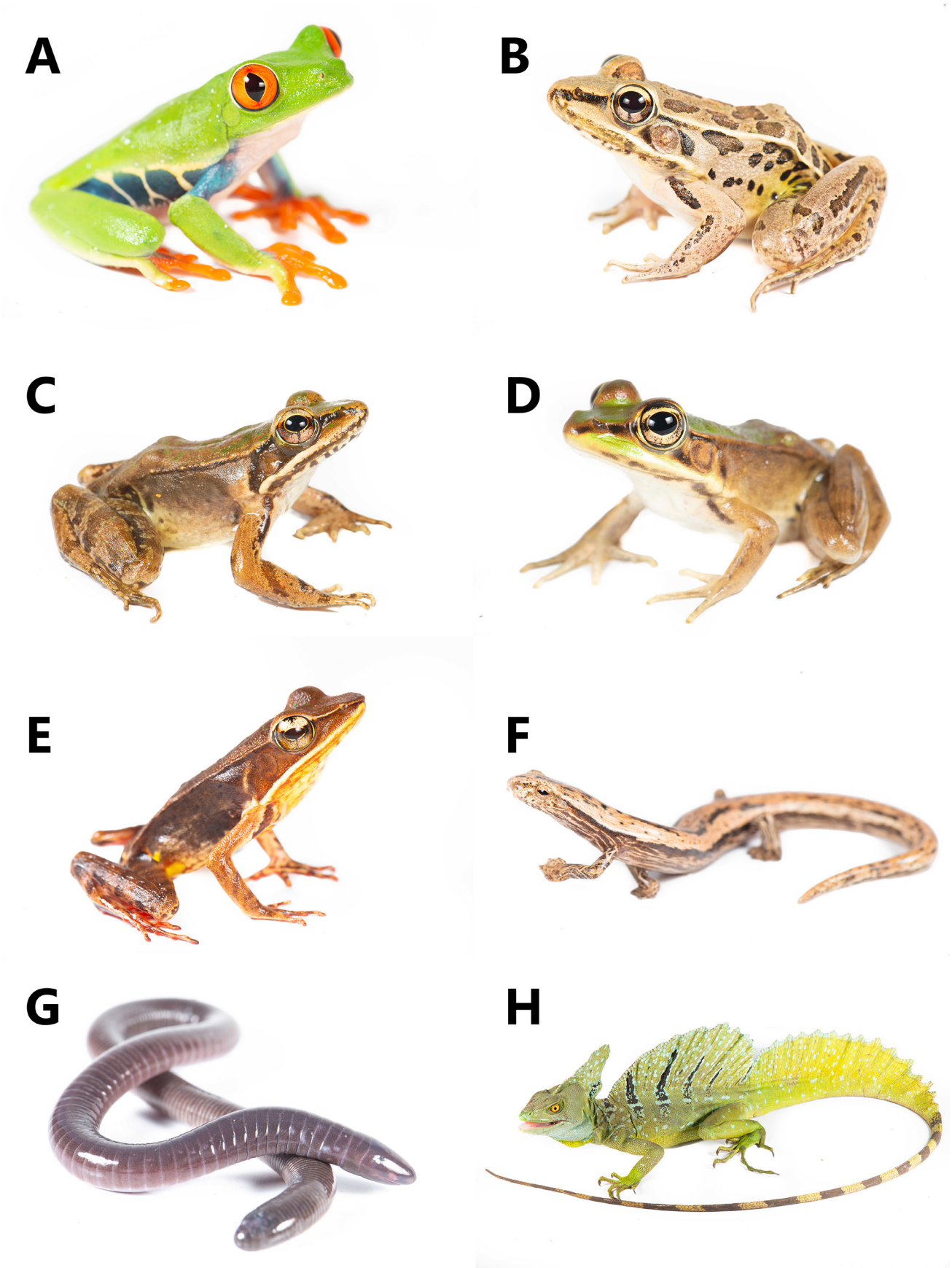

Figure 7. Species encountered during the 2018 UMMZ expedition to Nicaragua. **A.** *Agalychnis callidryas*, uncollected specimen from Las Brisas del Mogotón. **B.** *Lithobates forreri*, UMMZ 247074. **C.** *Lithobates maculatus*, UMMZ 247076. **D.** *Lithobates vaillanti*, UMMZ 248455. **E.** *Lithobates warszewitschii*, UMMZ 247078. **F.** *Bolitoglossa striatula*, UMMZ 247079. **G.** *Gymnopis multiplicata*, UMMZ 247082. **H.** *Basiliscus plumifrons*, UMMZ 248426.

Comments. The 16S tree groups our sample with a sequence from Honduras, with a Mexican sequence as an outgroup.

***Lithobates vaillanti* (Brocchi, 1877)**
Figure 7D; Appendix Figure A33

New records. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9728, −084.3390; 1.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 18:50; SVL 42 mm; 4.24 g; UMMZ 248455 (RAB3118); GenBank OM801096 • Same locality; 1.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 18:30; SVL 113 mm; 92.8 g; UMMZ 248391 (RAB3119).

Identification. Both individuals were easily recognizable by their coloration; males have a brighter green to tan-brown dorsum and may possess green along the edges of the dorsum. Their tympanum was larger than the eye, and fingers had no webbing. The dorsal surface and outer areas of legs are covered in small, white-tipped projections (Savage 2002; Köhler 2011).

***Lithobates warszewitschii* (Schmidt, 1857)**
Figure 7E; Appendix Figure A34

New records. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9776, −084.3337; 1.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 30 mm; 1.45 g; UMMZ 247077 (RAB3124); GenBank OM801100 • Same locality; 10.9715, −084.3343; 1.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 20:05; SVL 44 mm; 3.39 g; UMMZ 247078 (RAB3127); GenBank OM801101.

Identification. Both individuals were easily recognized from other ranids in the area by the presence of yellow spots on the posterior surface of the thighs. The tympanum is prominent but smaller than the eye, and the feet have two metatarsal tubercles. While color varies in this species, both of our individuals had a dark brown, mostly uniform dorsum with a pale yellowish venter (Hillis and Sá 1988; Köhler 2011).

Remarks. In a previous region-wide study, individuals sampled from Costa Rica and Panama did not group perfectly by collection location, and within-site genetic diversity is higher than would be expected if all individuals belonged to a single species (Cryer et al. 2019). Our samples nested within the Costa Rica samples from Cryer. We include the Cryer sample names in our appendix Figure A34.

Order Caudata
Family Plethodontidae

***Bolitoglossa striatula* (Noble, 1918)**
Figure 7F; Appendix Figure A35

New records. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9728, −084.3390; 1.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 18:50; SVL 61 mm; 3.19 g; UMMZ 247079 (RAB3117); GenBank OM801095 • Same locality; 10.9725, −084.3315; 2.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 21:15; SVL 61 mm; 3.21 g; UMMZ 247080 (RAB3152); GenBank OM801123 • Same locality; 10.9786, −084.3356; 5.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 20:25; SVL 49 mm; 1.78 g; UMMZ 247081 (RAB3203); GenBank OM801163.

Identification. Our individuals were easily identified by the two ventral–lateral stripes and pale-yellow venter. Except for *B. indio* (which has a less-contrasting dorsal pattern), other species in the same genus in Nicaragua are restricted to isolated volcanos (Sunyer et al. 2008).

Remarks. The most widespread species of salamander in Nicaragua (HerpetoNica 2015). The description of two localized species in southern Nicaragua indicates that further cryptic diversity in this species complex might be uncovered by morphological and genetic work (Sunyer et al. 2008).

Order Gymnophiona
Family Dermophiidae

***Gymnopis multiplicata* Peters, 1874**
Figure 7G; Appendix Figure A36

New records. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9708, −084.3353; 3.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 09:23; SVL 274 mm; UMMZ 247082 (RAB3167); GenBank OM801133 • Same locality; 10.9776, −084.3337; 4.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 11:00; SVL 143 mm; 2.73 g; UMMZ 247083 (RAB3175); GenBank OM801138 • Same locality; 10.9696, −084.3325; 5.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 370 mm; 22.1 g; UMMZ 248392 (RAB3197); GenBank OM801159.

Identification. We encountered three individuals of this species. All individuals had secondary annuli or grooves encircling the body to form segments, aligning with the vertebrae. Unlike the only other Nicaraguan caecilian (*Dermophis mexicanus* (Duméril & Bibron, 1841)), the annular grooves do not contrast with the overall dorsal coloration. It has a small tentacle that lies anterior to the eye. The eye is covered by skin and bone. Teeth in our individuals are monocuspid, recurved, and shorter in height in the posterior part of the jaw, which matches the descriptions for the species (Wake 1988; Köhler 2011).

Class Reptilia
Order Squamata
Family Corytophanidae

***Basiliscus plumifrons* (Linnaeus, 1758)**
Figure 7H; Appendix Figure A37

New records. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9728, −084.3390; 1.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 18:30; SVL 103 mm; tail 31 mm; 28.6 g; 1♀, UMMZ 247144 (RAB3136); GenBank OM801108 • Same locality; 10.9686, −084.3359; 2.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 19:32; SVL 218 mm; tail 615 mm; 245 g; 1♂, UMMZ 248426 (RAB3159); GenBank OM801128.

Identification. Both individuals were easily recognized by their bright green color with two rows of pale spots running parallel to the spine. The adult males possessed a head crest with two distinct lobes, differentiating this species from its congeners (Köhler 2001, 2008). The juvenile female had a uniformly colored chin region which is also characteristic in the species.

***Basiliscus vittatus* Wiegmann, 1828**
Figure 8A; Appendix Figure A38

New records. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.7045, −086.3615; 23.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 81 mm; tail 213 mm; 1♀, UMMZ 247145 (RAB3058); GenBank OM801043 • Same locality; 23.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 138 mm; tail 270 mm; 1♀, UMMZ 247146 (RAB3062); GenBank OM801047.

Identification. Both our individuals of this large brown lizard were identified by their keeled ventral scales, 1–2 mental shields that contact the infralabials, and a single, triangular head crest (Köhler 2008).

Distribution. Our individuals from Mogotón are the first records of the species for the Department of Nueva Segovia (Köhler 2001; HerpetoNica 2015; Sunyer et al. 2016).

***Corytophanes cristatus* (Merrem, 1820)**
Figure 8B; Appendix Figure A39

New records. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9736, −084.3311; 5.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 22:03 sleeping on a small tree; SVL 125 mm; tail; 263 mm; 48.9 g; UMMZ 247147 (RAB3210); GenBank OM801169 • Same locality; 10.9714, −084.3343; 5.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 22:27; SVL 88 mm; tail 191 mm; 21.7 g; UMMZ 247148 (RAB3212); GenBank OM801170.

Identification. Both of our individuals of this arboreal lizard varied in color from dark brown to olive-green, with yellow spots or crossbands. The venter on both was pale brown with sporadic dark spots. The helmet extended past the bony skull process, unlike in congeners. Both can further be characterized as belonging to this species by its smooth scales on the dorsal surface of the head (Townsend et al. 2004; Köhler 2008).

Family Anolidae

***Norops biporcatus* (Wiegmann, 1834)**
Figure 8C; Appendix Figure A40

New record. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9756, −084.3379; 6.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 19:25; SVL 93 mm; tail 150 mm; 14 g; UMMZ 247166 (RAB3216).

Identification. Both lizards were initially green in body, although like many anoles they rapidly changed color to brown, which is typical of this species. Our male had a blue and orange dewlap. Both individuals had keeled ventral scales (Armstead 2017).

Remarks. A recent gene tree based on the mitochondrial gene COI recovered strong genetic

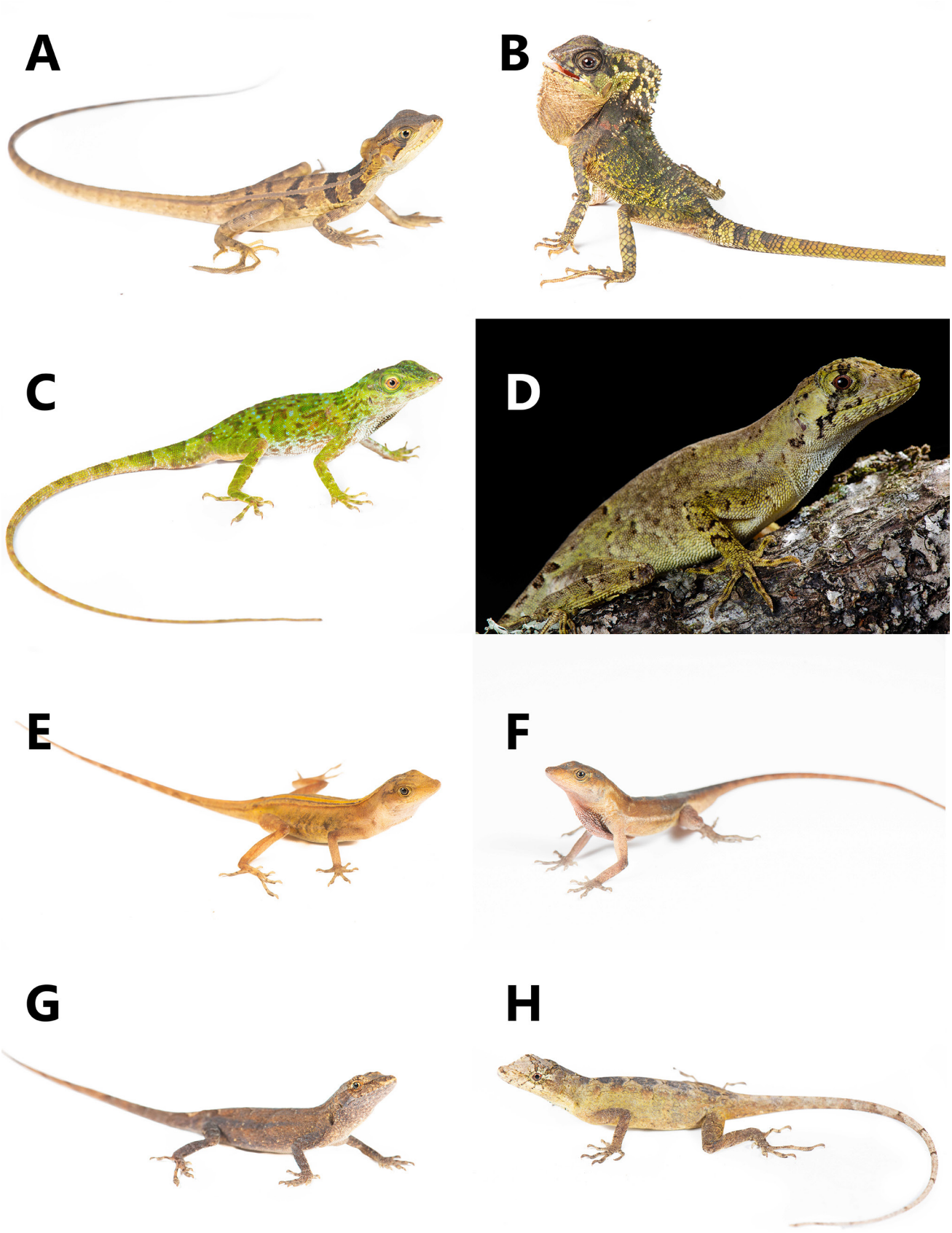

Figure 8. Species encountered during the 2018 UMMZ expedition to Nicaragua. **A.** Basiliscus vittatus, UMMZ 247146. **B.** Corytophanes cristatus, UMMZ 247147 **C.** Norops biporcatus, UMMZ 247166. **D.** Norops capito, uncollected specimen from Refugio Bartola. **E.** Norops cupreus, UMMZ 247168. **F.** Norops dariense, UMMZ 247172. **G.** Norops laeviventris, UMMZ 247173. **H.** Norops lemurinus, UMMZ 248433.

differentiation between specimens collected in central Costa Rica relative to those collected in northern Costa Rica and Honduras (Armstead 2017). Further sampling in southern Nicaragua will fill in the phylogeographic history of the northern Costa Rica–Honduras clade and identify whether the recovered split is a clean break or a more complex zone of intergradation.

***Norops capito* (Peters, 1863)**
Figure 8D; Appendix Figure A41

New record. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9776, −084.3337; 4.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 20:50; SVL 82 mm; tail 143 mm; 16.1 g; UMMZ 248432 (RAB3190); GenBank OM81153.

Identification. Our single individual had a grey body with green markings, a yellow-green dewlap and smooth scales with offset rows, which is characteristic of this species. The eyes are relatively large and surrounded by a strongly developed ring of supraorbital scales, and there is a relatively short and upturned snout (Köhler et al. 2005). Our specimen has the usual dark bar running between the eyes and continuing diagonally down to the corner of the mouth (Köhler 2001, 2008; Savage 2002).

***Norops cupreus* (Hallowell, 1861)**
Figure 8E; Appendix Figure A42

New records. NICARAGUA – **Dept. León** • Asososca Lake; 12.4272, −086.6613; 26.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 48 mm; tail 98 mm; 2.01 g; 1♂, UMMZ 247168 (RAB3082); GenBank OM801063 • Same locality; 12.4276, −086.6615; 26.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 44 mm; tail 84 mm; 1.91 g; 1♀, UMMZ 247169 (RAB3086); GenBank OM801067.

Identification. Our individuals were grey to brown lizards, with the males having a large dewlap with a basal orange to red-orange color. The dewlap fades to pink, then yellow, at the margins, all of which is typical of this species. The four central rows of dorsal scales are strongly keeled. (Köhler 2001, 2008; HerpetoNica 2015).

Remarks. The type locality for this species is in Nicaragua, and this species ranges from Honduras to Costa Rica from sea level to 1250 m (HerpetoNica 2015). This species is part of a taxonomically complex group of anoles. A population of the species from eastern El Salvador and Guatemala was elevated to a full species (Köhler and Kreutz 1999), leaving the range of *N. cupreus* encompassing Pacific dry forest from Honduras to Costa Rica. In addition, *N. dariense* (discussed below) has been variably considered a separate species in work focusing on Costa Rican animals (Savage 2002; Sunyer 2009; McCranie et al. 2019) or as a subspecies of *N. cupreus* in publications concerned with Honduran or Nicaraguan animals (McCranie and Köhler 2015). We suggest that further geographical sampling and genetic work throughout the species' ranges could provide valuable insights into whether the current classification represents several distinct species, a species complex, or a single species with variable color and scalation. Specifically, the limits of the distribution of both species in central Nicaragua which may illuminate complex ecological and evolutionary relationships between the two taxa (McCranie and Köhler 2015; McCranie et al. 2019).

Distribution. While this is a common species in Pacific Nicaragua, our individuals are the first records of the species in the Department of León (Köhler 2001; HerpetoNica 2015; Sunyer et al. 2016). Note that the records from GBIF and IUCN polygon in the map includes records that should belong to *N. dariense* (see below).

***Norops dariense* (Fitch and Seigel, 1984)**
Figure 8F; Appendix Figure A43

New records. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.7416, −086.3811; 17.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 18:10; SVL 51 mm; tail 15 mm; 2.97 g; 1♀, UMMZ 247170 (RAB3026); GenBank OM801014 • Same locality; 13.7402, −086.3785; 17.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 19:04; SVL 49 mm; tail 83 mm; 2.6 g; 1♀, UMMZ 247171 (RAB3028); GenBank OM801016 • Same locality; 13.7402, −086.379; 20.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 09:42; SVL 46 mm; tail 84 mm; 2.13 g; 1♂, UMMZ 247172 (RAB3038); GenBank OM801026.

Identification. This taxon is part of the *N. cupreus* species group, discussed above. Our individuals can be distinguished by its uniformly brown dewlap (Sunyer 2009; HerpetoNica 2015; McCranie et al. 2019).

Distribution. Our individuals are the first records of the species in the Department of Nueva Segovia (Köhler 2001; HerpetoNica 2015; Sunyer et al. 2016). Note that the records in the map based on data from GBIF and the IUCN polygon correspond to *N. cupreus* since *N. dariense* still does not figure as a separate species on these datasets.

***Norops laeviventris* (Wiegmann, 1834)**
Figure 8G; Appendix Figure A44

New record. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.75014, −086.3764; 21.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 20:30; SVL 41 mm; tail 72 mm; 1.86 g; 1♀, UMMZ 247173 (RAB3050); GenBank OM801037.

Identification. Our single individual of this species was easily identified as belonging to this species by the overall greyish-brown body and completely white dewlap (McCranie and Köhler 2015).

Remarks. Our 16S tree strongly separates Nicaraguan and Honduran sequences, perhaps pointing to genetic differentiation across the species' range in this highland-specialist lizard. Nicaraguan populations may correspond to *Norops intermedius* Nicholson, 2002 (McCranie and Köhler 2015), which provides a possible explanation for the 16S tree topology.

Distribution. Our specimen is the first record of the species in the Department of Nueva Segovia (Köhler 2001; HerpetoNica 2015; Sunyer et al. 2016).

***Norops lemurinus* (Cope, 1861)**
Figure 8H; Appendix Figure A45

New records. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9775, −084.3364; 3.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 21:30; SVL 55 mm; tail 55 mm; 3.8 g; 1♀, UMMZ 248433 (RAB3177); GenBank 801140 • Same locality; 10.9716, −084.3371; 4.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 19:14; SVL 45 mm; tail 97 mm; 2.33 g; 1♂, UMMZ 247174 (RAB3192); GenBank OM801155 • Same locality; 10.9776, −084.3337; 4.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 60 mm; tail 124 mm; 4.83 g; 1♀, UMMZ 247175 (RAB3194); GenBank OM801157.

Identification. Our male specimens were easily recognizable as belonging to this species by their orange-red dewlap. All specimens had two weakly enlarged dorsal scale rows, and relatively long hind limbs which is also diagnostic for the species (Köhler 2008; McCranie and Köhler 2015).

***Norops limifrons* (Cope, 1862)**
Figure 9A; Appendix Figure A46

New records. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9776, −084.3337; 1.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 19:03; SVL 36 mm; tail 76 mm; 0.71 g; 1♂, UMMZ 247176 (RAB3139); GenBank OM801111 • Same locality; 10.9728, −084.3390; 1.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 18:30; SVL 39 mm; tail 76 mm; 1.01 g; 1♀, UMMZ 248434 (RAB3140); GenBank OM801112 • Same locality; 10.9720, −084.3381; 1.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 19:14; SVL 37 mm; tail 83 mm; 0.92 g; 1♂, UMMZ 247177 (RAB3141); GenBank OM801113 • Same locality; 10.9719, −084.3341; 1.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 20:20; SVL 43 mm; tail 93 mm; 1.49 g; 1♀, UMMZ 247178 (RAB3142); GenBank OM801114 • Same locality; 10.9730, −084.3312; 3.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 21:20; SVL 40 mm; tail 87 mm; 2.82 g; UMMZ 248439 (RAB 3168); GenBank OM801134 • Same locality; 10.9764, −084.3355; 3.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 21:11; SVL 42 mm; tail 77 mm; 1.25 g; 1♀, UMMZ 247164 (RAB3180); GenBank OM801143.

Identification. Our specimens were easily identifiable as belonging to this species by the grey-brown body, dark bands on the tail, and when present, a white dewlap with a basal orange spot (Savage 2002; Köhler and Sunyer 2008).

Remarks. This is a distinct species with highly localized distribution, similar to *N. limifrons* in Panama (Köhler and Sunyer 2008). Further morphological and genetic work throughout the taxon's range could uncover cryptic diversity.

***Norops mccraniei* (Peters, 1863)**
Figure 9B; Appendix Figure A47

New records. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.7300, −086.3752; 21.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 09:30; SVL 53 mm; tail 67 mm; 4.01 g; 1♂, UMMZ 247187 (RAB3042); GenBank OM801030 • Same locality; 13.7402, −086.379; 22.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 53 mm; tail 55 mm (incomplete); 5.17 g; 1♀, UMMZ 247188 (RAB3055).

Identification. Both of our specimens were identified by their grey to brown, short-limbed body. They both had enlarged, keeled scales in front of the ear openings, and the large, orange male dewlap had a dark streak at the center (Köhler et al. 2016).

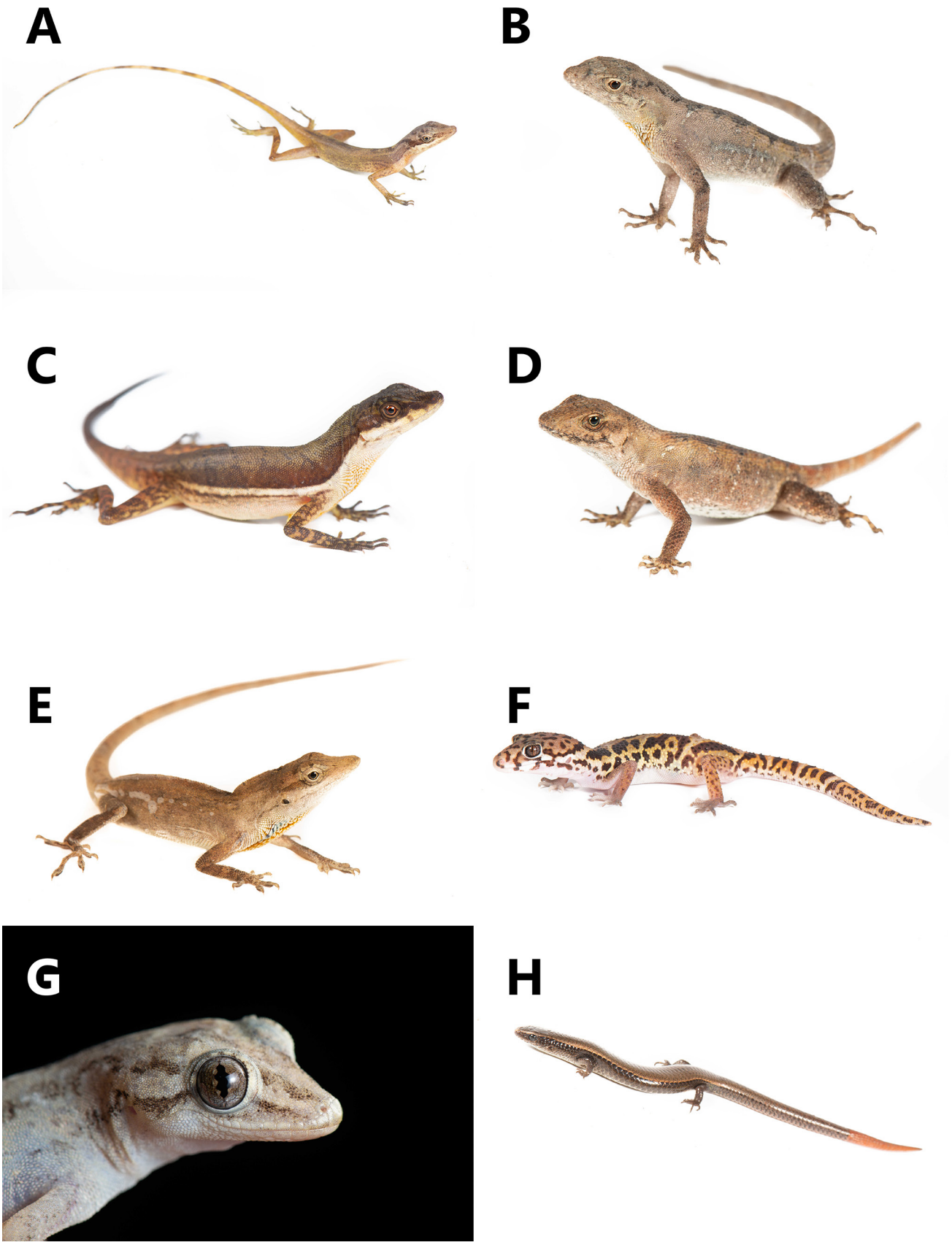

Figure 9. Species encountered during the 2018 UMMZ expedition to Nicaragua. **A.** *Norops limifrons*, uncollected specimen from Refugio Bartola. **B.** *Norops mccraniei*, UMMZ 247187. **C.** *Norops oxylophus*, UMMZ 248437. **D.** *Norops quaggulus*, UMMZ 247180. **E.** *Norops unilobatus*, UMMZ 247186. **F.** *Coleonyx mitratus*, UMMZ 247150 **G.** *Hemidactylus frenatus*, uncollected specimen from Asososca Lake. **H.** *Gymnophthalmus speciosus*, UMMZ 247201.

Remarks. Previous genetic work offers some evidence of a basal lineage occupying northeastern Honduras, with genetically nested lineages in central and southern Honduras (Köhler et al. 2016). This pattern could indicate an expansion southward and westward by the species. If this is the case, our samples would represent the extreme boundary of such an expansion. Note that *N. mccraniei* is a relatively recently split from *N. tropidonotus* and the IUCN polygon has not been updated; the polygon corresponds instead to the latter species (Köhler et al. 2016).

Distribution. Our two individuals are the first of this species reported in the Department of Nueva Segovia (Köhler 2001; HerpetoNica 2015; Sunyer et al. 2016).

***Norops oxylophus* (Cope, 1875)**
Figure 9C; Appendix Figure A48

New records. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9725, −084.3315; VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 21:09; SVL 39 mm; tail 43 mm; 1.48 g; 2. UMMZ 248436 (RAB3161) • Same locality; 10.9776, −084.3337; 5.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 69 mm; tail 87 mm; 7.5g; UMMZ 248437 (RAB3205); GenBank OM801164.

Identification. Both of our specimens of this semi-aquatic lizard were easily identifiable by having a yellow dewlap and smooth or weakly keeled dorsal scales. This lizard is a uniformly dark brown with cream-colored lateral stripes (Köhler 2001; Muñoz et al. 2015).

Remarks. Our 16S tree showed that our sample clustered with a Costa Rican sequence and was differentiated from Panamanian sequences.

***Norops quaggulus* (Cope, 1885)**
Figure 9D; Appendix Figure A49

New records. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.7402, −086.379; 21.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 45 mm; tail 78 mm; 2.64 g; 1♀, UMMZ 247179 (RAB 3040); GenBank OM801028 • Same locality; 25.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; around 17:00; SVL 49 mm; tail 80 mm; 2.95 g; 1♀, UMMZ 247180 (RAB3076); GenBank OM801058 – **Dept. Rio San Juan** • Refugio Bartola; 10.9750, −084.3294; 5.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 21:26; SVL 33 mm; tail 35 mm; 0.91 g; UMMZ 247181 (RAB3206); GenBank OM801165 • Same locality; 10.9722, −084.3383; 5.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 22:45; SVL 37 mm; tail 37 mm; 1.26 g; UMMZ 247182 (RAB3208); GenBank OM801167 • Same locality; 10.9706, −084.3333; 5.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 34 mm; tail 47 mm; 0.95 g; UMMZ 247183 (RAB3209); GenBank OM801168.

Identification. All our specimens had 8–10 enlarged mid-dorsal scale rows and three enlarged scales above the eye, which is typical of this species. They also had a very evident postaxillary pocket, which is also diagnostic (Savage 2002; Köhler et al. 2006).

Remarks. *Norops quaggulus* was separated from *N. humilis*, which ranges across southern Nicaragua, Costa Rica and into Panama, based on hemipenal morphology (Köhler et al. 2003). Phylogeographic work placed *N. quaggulus* as a monophyletic group nested within taxa identified as *N. humilis*. The *N. humilis* complex ranges from Panama to Costa Rica, indicating a history of northward expansion in this group (Phillips et al. 2015).

Distribution. Our individuals from Mogotón are the first ones for the species in the Department of Nueva Segovia (Köhler 2001; HerpetoNica 2015; Sunyer et al. 2016).

***Norops unilobatus* (Köhler and Veselý, 2010)**
Figure 9E; Appendix Figure A50

New records. NICARAGUA – **Dept. León** • Asososca Lake; 12.4285, −086.6631; 27.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 42 mm; tail 93 mm; 1♂, UMMZ 247184 (RAB3091); GenBank OM801072 • Same locality; 27.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 45 mm; tail 54 mm; 1♀, UMMZ 247185 (RAB3092); GenBank OM801073 • Same locality; 12.4272, −086.6613; 27.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 46 mm; tail 95 mm; 1♂, UMMZ 247186 (RAB3111); GenBank OM801089.

Identification. Our specimens of this short-legged anole (longest toe of hindlimb does not pass external ear when bent forward along the body) had ventral scales that are strongly keeled, all of which is consistent with descriptions of this species (Köhler and Vesely 2010). Our male specimens have a yellow-orange dewlap with a large blue-purple blotch (Köhler and Vesely 2010; HerpetoNica 2015).

Remarks. This species belongs to a complex that encompasses three taxa with distinct hemipenal and

dewlap morphology (Köhler and Vesely 2010). Our samples were taken from a zone of contact of *N. wellbornae* and *N. unilobatus*, species that were both formerly included under *N. sericeus*. Further genetic, ecological, and morphological work in the area could determine whether splitting *N. sericeus* into several species is taxonomically warranted.

Family Eublepharidae

***Coleonyx mitratus* (Peters, 1863)**
Figure 9F; Appendix Figure A51

New records. NICARAGUA – Dept. León • Asososca Lake; 12.4275, −086.6608; 26.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 19:20; SVL 68 mm; tail 14 mm (incomplete); 4.35 g; UMMZ 247149 (RAB3081); GenBank OM801062 • Same locality; 26.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; 19:20; SVL 80 mm; tail 56 mm; 6.52 g; UMMZ 247150 (RAB3084); GenBank OM801065.

Identification. Our two specimens of this species are easily distinguished from the only other congeneric species in Central America, *Coleonyx elegans* Gray, 1845, by a lack of scaly sheath covering the claws. The first sublabial is square and lacks small scales behind internasals (Savage 2002; Köhler 2008; McCranie 2018). Additionally, this species is the only member of the family Eublepharidae in Nicaragua (HerpetoNica 2015).

Family Gekkonidae

***Hemidactylus frenatus* Duméril & Bibron, 1836**
Figure 9G

New record. NICARAGUA – Dept. León • Asososca Lake; 12.4281, −086.6612; 28.V.2018; 15:30; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 56 mm; tail 70 mm; 4.05 g; UMMZ 248428 (RAB 3100); GenBank OM801079.

Identification. Our specimens can be distinguished from other Gekkota genera in the region by a combination of the presence of large tubercles on the dorsal surface and a lack of tubercles on the upper surface of hind limbs and above the ear opening. Their vocalizations are distinct and can be heard at night. (Rödder et al. 2008; HerpetoNica 2015; McCranie 2018).

Distribution. Our individual is the first one of the species for the Department of León (Köhler 2001; HerpetoNica 2015; Sunyer et al. 2016). However, this exotic species is well distributed in Nicaragua, and we observed many individuals, usually associated with human activity in and around buildings. This species has been introduced to the Yucatán Peninsula, Guatemala, El Salvador, Nicaragua, Costa Rica, and Panama (HerpetoNica 2015; McCranie 2018).

Family Gymnophthalmidae

***Gymnophthalmus speciosus* (Hallowell, 1861)**
Figure 9H; Appendix Figure A52

New record. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.6841, −086.3652; 23.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 46 mm; tail 55 mm; 1.36 g; UMMZ 247201 (RAB3061); GenBank OM801046.

Identification. Our individual was easily recognized as belonging to this species by having a tail with a red tip and a shiny and smooth cylindrical body. The lighter brown dorsal color contrasts with the darker scales along the side of the body. Front limbs have four fingers while the back legs have five (García-Roa and Sunyer 2012).

Distribution. Our individual is the first record of the species in the Department of Nueva Segovia (Köhler 2001; García-Roa and Sunyer 2012; HerpetoNica 2015; Sunyer et al. 2016).

Family Phrynosomatidae

***Sceloporus malachiticus* Cope, 1864**
Figure 10A; Appendix Figure A53

New records. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.7475, −086.3811; 19.V.2018; 12:18 found at rest at ground layer in the sun at an elevation of 1430 m; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 80 mm; tail 91 mm; 11.12 g; 1♀, UMMZ 247156 (RAB 3036); GenBank OM801024 • Same locality; 13.7402, −086.379; 21.V.2018; 09:25 found at rest in the soil; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 85 mm; tail 83 mm; 14.64 g; 1♂, UMMZ 247157 (RAB3041); GenBank OM801024.

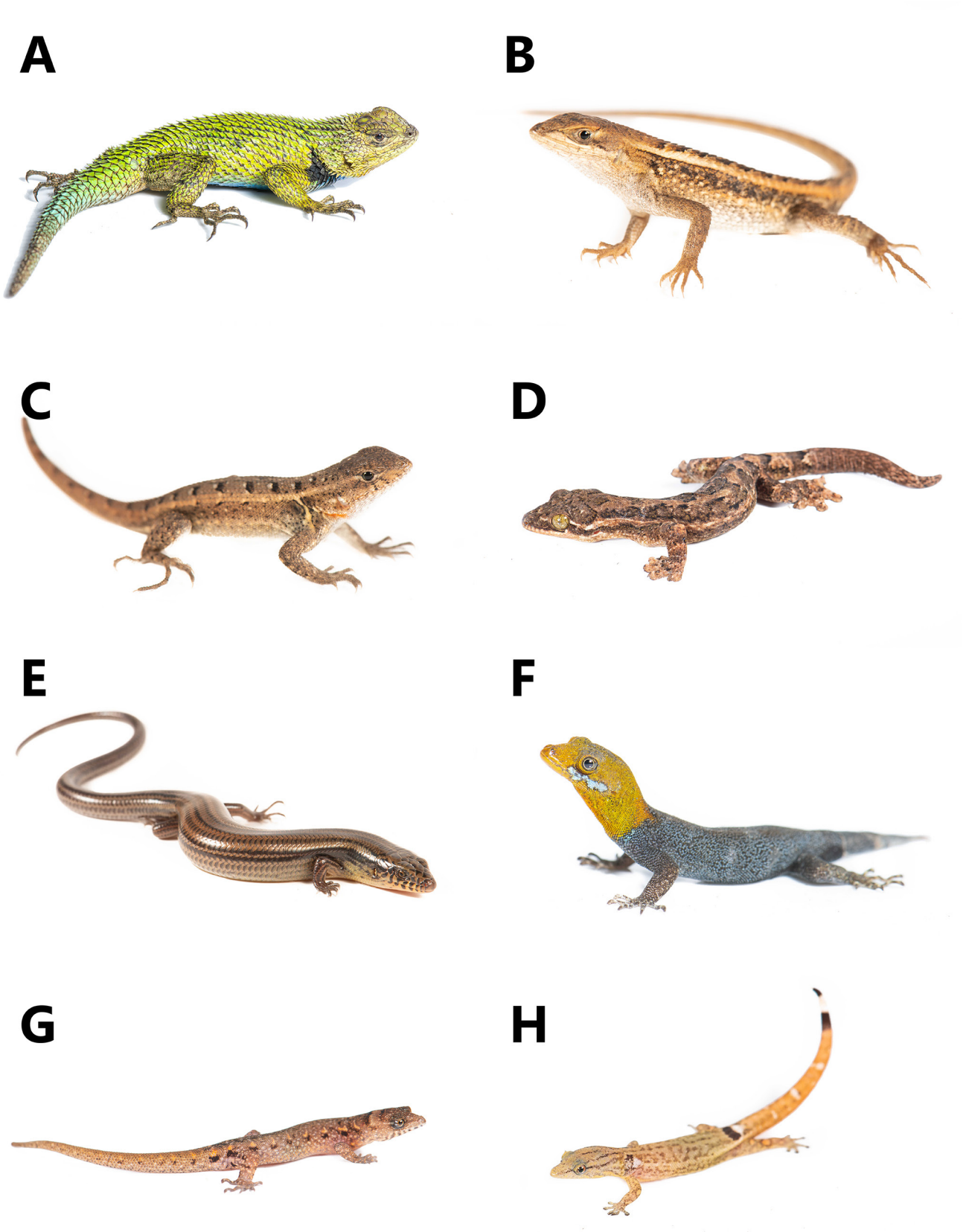

Figure 10. Species encountered during the 2018 UMMZ expedition to Nicaragua. **A.** *Sceloporus malachiticus*, uncollected specimen from Las Brisas del Mogotón. **B.** *Sceloporus squamosus*, UMMZ 247160. **C.** *Sceloporus variabilis*, uncollected specimen from Asososca Lake. **D.** *Thecadactylus rapicauda*, UMMZ 247155. **E.** *Mesoscincus managuae*, UMMZ 247189. **F.** *Gonatodes albogularis*, uncollected specimen from Masaya, Masaya department. **G.** *Lepidoblepharis xanthostigma*, UMMZ 248429. **H.** *Sphaerodactylus millepunctatus*, UMMZ 248429.

Identification. We found a male and female of this large green lizard with the characteristic strongly keeled scales. In Nicaragua this species is easily distinguished from congeners by coloration and body size (Savage 2002; HerpetoNica 2015).

Remarks. The lizard can appear momentarily dark grey or black when cold but will never appear striped (Savage 2002; HerpetoNica 2015). A taxonomic designation within the *Sceloporus formosus* Wiegmann, 1834 species group that has recently been broken into several species (McCranie 2018). Nicaraguan populations of this species likely correspond to *S. hondurensis* McCranie, 2018 or to an undescribed species (McCranie 2018). We could not corroborate if our samples belong to the species *S. hondurensis* because there is no reference for 16S genotypes available of that species in GenBank.

***Sceloporus squamosus* Bocourt, 1874**
Figure 10B; Appendix Figure A54

New records. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.6826, −086.3657; 23.V.2018; 10:25; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 45 mm; tail 91 mm; 2.8 g; UMMZ 247158 (RAB3065); GenBank OM801050 – **Dept. León** • Asososca Lake; 12.4272, −086.6613; 26.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 49 mm; tail 113 mm; 3.81 g; 1♂, UMMZ 247159 (RAB3083); GenBank OM801064 • Same locality; 28.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 51 mm; tail 119 mm; 3.11 g; UMMZ 247160 (RAB3107); GenBank OM801085.

Identification. Our three specimens were easily recognized as belonging to this species by its lack of a post-femoral dermal pocket, strongly keeled scales on the base of the tail and lower ventral surface, and <12 femoral pores, and lack of enlarged post-cloacal scales (McCranie 2018).

***Sceloporus variabilis* Wiegmann, 1834**
Figure 10C; Appendix Figure A55

New records. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.7402, −086.379; 21.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 56 mm; tail 75 mm; 8.04 g; 1♀, UMMZ 247161 (RAB3039); GenBank OM801027 • Same locality; 23.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 62 mm; tail 53 mm; 8.79 g; 1♂, UMMZ247162 (RAB3063); GenBank OM801048 – **Dept. León** • Asososca Lake; 12.4272, −086.6613; 28.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 36 mm; tail 33 mm; 1.55 g; UMMZ 248431 (RAB3106); GenBank OM801084.

Identification. All our specimens had a postfemoral pocket, distinguishing it from the similar-looking *S. squamosus* (McCranie 2018). Other significant characteristics from our specimens that match this species description included dorsal scales 1.5–2.0 times larger than lateral scales and 12 or more femoral pores. Coloration consists of two light dorsolateral lines present with a series of dark spots; males possess paired, blue-bordered pink patches on the ventral surface (Köhler 2008).

Remarks. Recent genetic and morphometric work suggested that the *variabilis* species complex is polyphyletic, with the species *S. teapensis* Günther, 1890 and *S. smithi* Hartweg & J.A. Oliver, 1937 nested within taxa formerly assigned to *S. variabilis* (Solis-Zurita et al. 2019). Solis-Zurita et al. suggested elevating all *S. variabilis* south of Mexico to species status under the name *S. olloporus* H.M. Smith, 1937. However, all putative *S. olloporus* included in the study were collected in southern Mexico, so we do not apply the name to our specimens.

Family Phyllodactylidae

***Thecadactylus rapicauda* (Houttuyn, 1782)**
Figure 10D; Appendix Figure A56

New record. NICARAGUA – Dept. Rio San Juan • Refugio Bartola; 10.9776, −084.3337; 9.VI.2018; 19:15; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 103 mm; tail 66 mm; 20 g; 1♂, UMMZ 247155 (RAB3239); GenBank OM801191.

Identification. Our specimen can be distinguished from other neotropical geckos by their large size and the combination of expanded sensorial pads under the bases of all digits, unique cloacal sacs. Additionally, it had a deep subdigital sulcus beneath each toe that houses the claw and divides the lamellae into a double series with the wide, ridged toe pads each divided into two lobes (Russell and Bauer 2002; Savage 2002; McCranie 2018).

Remarks. Our specimen falls in a sampling gap in a phylogeographic study of the species based on the mitochondrial COI gene (Kronauer et al. 2005). In that study, samples from north of Nicaragua formed a clade with lizards from Trinidad and Tobago, while samples from Costa Rica clustered with sequences from the Lesser Antilles. Sampling this species from across its Central American and Caribbean range and sequencing more genes might resolve the complex biogeographic history of the northern range of *T. rapicauda*.

Family Scincidae

***Mesoscincus managuae* (Dunn, 1933)**
Figure 10E; Appendix Figure A57

New record. NICARAGUA – **Dept. León** • Asososca Lake; 12.4285, −086.6631; 27.V.2018; 20:00; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 81 mm; tail 127 mm; 9.8 g; 1♂, UMMZ 247189 (RAB3097); GenBank OM801077.

Identification. Our specimen of this large skink was easily recognizable by the yellow body and the many longitudinal black stripes along the length of the body and enlarged dorsal scales (McCranie 2018). Other skinks in the region have a well-defined, unique, broad dorsal stripe and dark face masks (Köhler 2008; HerpetoNica 2015).

Family Sphaerodactylidae

***Gonatodes albogularis* (Duméril & Bibron, 1836)**
Figure 10F; Appendix Figure A58

New records. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9776, −084.3337; 2.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 80 mm; tail 50 mm; 1.5 g; 1♀, UMMZ 247151 (RAB3144); GenBank OM801116 • Same locality; 2.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 40 mm; tail 46 mm; 1.77 g; 1♂, UMMZ 247152 (RAB3163); GenBank OM801130.

Identification. We found two individuals of this diurnal, brightly colored gecko. The female was cryptically colored, while the male had a bright-yellow head as it is characteristic of the species (Savage 2002).

Remarks. Our 16S tree is poorly supported and should be interpreted with caution. The Bartola samples nested in a clade made up of El Salvadoran and one Costa Rican sample, while a second Costa Rican sequence and a Panamanian sequence formed outgroups.

***Lepidoblepharis xanthostigma* (Noble, 1916)**
Figure 10G; Appendix Figure A59

New record. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9757, −084.3306; 5.VI.2018; 21:15; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 26 mm; tail 31 mm; 0.35 g; UMMZ 248429 (RAB3211).

Identification. Our specimen was easily identifiable from similar species (e.g., females of *G. albogularis*) by juxtaposed dorsal scales and enlarged median subcaudal scales (Köhler 2008).

Remarks. A revision of Panamanian *Lepidoblepharis* found extensive cryptic variation in the genus (Batista et al. 2015), which may indicate undiscovered cryptic diversity throughout the rest of the species' Central American range. Alternatively, the genus might follow ecologically similar species in having a large amount of ancestral diversity in Panama, with more recent range expansions northward leading to fewer cryptic lineages in northern Central America.

***Sphaerodactylus millepunctatus* Hallowell, 1861**
Figure 10H; Appendix Figure A60

New record. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9757, −084.3306; 8.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 26 mm; tail 31 mm; 0.45 g; UMMZ 248429 (RAB3211).

Identification. Our individual can be identified as belonging to this species by the distinct dorsal spots that are larger than single scales. The individual also has two supranasal scales and single row of subcaudal scales, lacks longitudinal stripes on the dorsum, and has a black and white tail tip; all of these characters are consistent with this species (Savage 2002; Köhler 2008; McCranie and Hedges 2012).

Family Sphenomorphidae

***Scincella cherrei* (Cope, 1893)**
Figure 11A; Appendix Figure A61

New records. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.7409, −086.3782; 17.V.2018; 19:20; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 44 mm; tail 45 mm; 1.5 g; UMMZ 247190 (RAB3020) • Same locality; 13.7428, −086.3791; 17.V.2018; 19:59; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 55 mm; tail 32 mm; 3.14 g; 1♀, UMMZ 247191 (RAB3021); GenBank

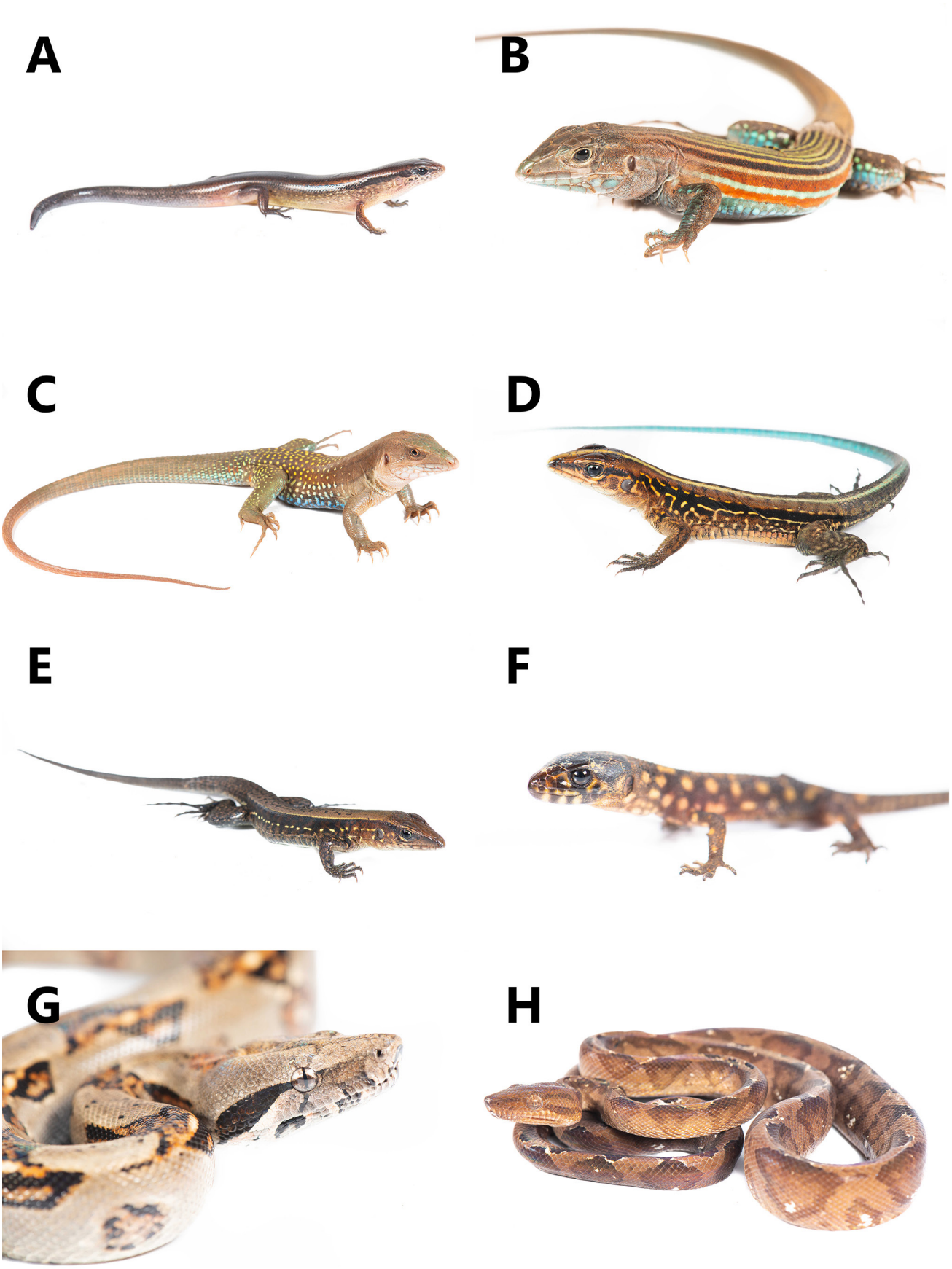

Figure 11. Species encountered during the 2018 UMMZ expedition to Nicaragua. **A.** *Scincella cherrei*, UMMZ 247192 **B.** *Aspidoscelis deppii*, UMMZ 247199. **C.** *Aspidoscelis motaguae*, UMMZ 247203. **D.** *Holcosus festivus*, uncollected specimen from Refugio Bartola. **E.** *Holcosus undulatus*, uncollected specimen. **F.** *Lepidophyma flavimaculatum*, UMMZ 247202. **G.** *Boa imperator*, uncollected specimen from Las Brisas del Mogotón. **H.** *Corallus annulatus*, uncollected specimen from Refugio Bartola.

OM801010 – **Dept. Rio San Juan** • Refugio Bartola; 10.9696, −084.3325; 7.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 52 mm; tail 56 mm; 2.82 g; 1♂, UMMZ 247192 (RAB3226); GenBank OM801182.

Identification. The individuals we found were easily identifiable as members of this species by the sides marked by a thick black band that starts at the snout, crosses the eye, and dissolves (unlike in other co-occurring species) on the mid-body. It has two frontoparietal scales, no enlarged nuchal scales, and the tail has a brown tip (Savage 2002; McCranie 2018).

Distribution. Our individuals from Mogotón are the first records of the species in the Department of Nueva Segovia (Köhler 2001, HerpetoNica 2015, Sunyer et al. 2016).

Family Teiidae

***Aspidoscelis deppii* (Weigmann, 1834)**
Figure 11B; Appendix Figure A62

New records. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.6826, −086.3657; 23.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 64 mm; tail 125 mm; 6.07 g; 1♀, UMMZ 247198 (RAB3064); GenBank OM801049 – **Dept. León** • Asososca Lake; 12.4272, −086.6613; 29.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 81 mm; tail 61 mm; 11.04 g; 1♀, UMMZ 247199 (RAB3108); GenBank OM801086 • Same locality; 29.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 92 mm; tail 209 mm; 18.05 g; 1♂, UMMZ 247200 (RAB3109); GenBank OM801087.

Identification. This is a moderately-sized and easily identifiable slender whiptail. All our individuals had three supraoculars and lacked further enlarged scales touching the enlarged forearm scale row. The color pattern is very characteristic of this species, with black "racing stripes" on a lighter background on the dorsal surface and a blue tail (McCranie 2018).

Remarks. This is a very common lizard in the Pacific of Nicaragua (Martínez-Fonseca et al. 2019b). All our specimens were moving across the ground during the day.

***Aspidoscelis motaguae* (Sackett, 1941)**
Figure 11C; Appendix Figure A63

New record. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.6826, −086.3659; 25.V.2018; 08:20; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 140 mm; tail 314 mm; 93.8 g; 1♂, UMMZ 247203 (RAB3070); GenBank OM801054.

Identification. Our individual is a heavyset whiptail that can be easily distinguished from other whiptail species by its large size. The individual has an extra line of enlarged scales on the rear side of the enlarged forearm scale row and four enlarged supraoculars. The dorsum has a spotted pattern, and the tail is slightly red to brown (Köhler 2008; McCranie 2018).

Remarks. Our record represents the third known record and locality of the species in Nicaragua (Köhler et al. 2013; Sunyer et al. 2016).

***Holcosus festivus* (Lichtenstein & Martens, 1856)**
Figure 11D; Appendix Figure A64

New records. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9730, −084.3336; 1.VI.2018; 20:35; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 59 mm; tail 143 mm; 5.6 g; 1♀, UMMZ 248442 (RAB3134); OM801106 • Same locality; 10.9776, −084.3337; 2.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 107 mm; tail 234 mm; 32.8 g; 1♀, UMMZ 247194 (RAB3146); GenBank OM801118 • Same locality; 10.9740, −084.3347; 8.VI.2018; 11:22; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 49 mm; tail 102 mm; 2.8 g; UMMZ 247195 (RAB3225); GenBank OM801181.

Identification. Our individuals were easily identified as members of this species from others in the genus by the greatly enlarged scales in mid-throat which are not arranged in a longitudinal row (Köhler 2008). They also have eight rows of ventral scales (Savage 2002).

Remarks. The 16S tree strongly clusters our Bartola sample with another sequence available from Nicaragua and separates the cluster from conspecific samples taken from Panama.

***Holcosus undulatus* (Wiegmann, 1834)**
Figure 11E; Appendix Figure A65

New records. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.7402, −086.3781; 17.V.2018; 19:10; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 107 mm; tail 230 mm; 39.9 g;

1♂, UMMZ 247193 (RAB3029); GenBank OM801017 • Same locality; 13.7335, −086.3758; 21.V.2018; 08:13; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 48 mm; tail 110 mm; 3.44 g; UMMZ 247196 (RAB3043); GenBank OM801031 – **Dept. Rio San Juan** • Refugio Bartola; 10.9776, −084.3337; 2.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 79 mm; tail 136 mm; 11.2 g; 1♀, UMMZ 247197 (RAB3145); GenBank OM801117 • Same locality; 10.9786, −084.3381; 6.VI.2018; 20:25; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 67 mm; tail 144 mm; 8.5 g; UMMZ 248443 (RAB 3217); GenBank OM801173.

Identification. Our moderately sized individuals can be identified by an enlarged patch of scales on the throat arranged in a longitudinal pattern surrounded by smaller, granular scales, and 12 rows of ventral scales (McCranie 2018).

Remarks. Our 16S sequences from northern Nicaragua cluster strongly together and are nested within more northerly sequences.

Family Xantusiidae

***Lepidophyma flavimaculatum* Duméril, 1851**
Figure 11F; Appendix Figure A66

New record. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9742, −084.3364; 3.VI.2018; 19:54 under a log; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 37 mm; tail 47 mm; 0.76 g; 1♀, UMMZ 247202 (RAB 3179); GenBank OM801142.

Identification. Our individual of this cryptic fossorial species was easily distinguished by its rough, almost conical dorsal scales, large smooth head scales, distinct neck, and dark coloration with white markings (Savage 2002). Our individual also lacked eyelids and the yellow dots that cover the otherwise dark body which are distinctive characteristics of the only species in the family found in Nicaragua (HerpetoNica 2015).

Remarks. Our 16S tree recovers three strongly supported clades: a Belize group, a Nicaragua-Honduras clade that includes our Bartola specimen, and a southern clade that includes Costa Rican and Panamanian samples. Within each clade, tree topology is poorly resolved.

Family Boidae

***Boa imperator* Daudin, 1803**
Figure 11G

New records. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.7130, −086.3656; 3.VI.2018; JGMF, IAH, EPW, MRG, MAFM, JCLM, IVM, DN, GGP obs.; moving actively during the day at ~10:30; not collected – **Dept. Rio San Juan** • Refugio Bartola; 10.9742, −084.3364; obs.; found at night moving on the ground ~22:00; not collected.

Identification. We encountered two young adults of this species during our expedition. They were easily identifiable with the irregular scales on all dorsal surfaces of body and head and the absence of labial pits. Their short, muscular tails are redder and paler yellow, more brightly colored than the rest of the body (Savage 2002; Köhler 2008).

Remarks. We did not collect this species due to CITES restrictions in our permits. The photo is of an individual captured and released in Las Brisas del Mogotón.

***Corallus annulatus* (Cope, 1875)**
Figure 11H

New record. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9742, −084.3364; 3.VI.2018; JGMF, IAH, EPW, MRG, MAFM, JCLM, IVM, DN, GGP obs.; resting on a tree branch 1.3 m above ground at ~21:00; not collected.

Identification. We encountered one individual of this relatively rare species. It was easily identifiable by the several enlarge shields in snout and the presence of labial pits (Köhler 2008). The only species in the genus that occurs in Nicaragua is also easily distinguished by the multiple dark rings (annulated) pattern along both flanks of the body (HerpetoNica 2015).

Remarks. We did not collect this species due to CITES restrictions in our permits. The photo is of an individual captured and released in Refugio Bartola.

Family Colubridae

***Chironius grandisquamis* (Peters, 1868)**
Figure 12A; Appendix Figure A67

New record. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9678, −084.3359; 2.VI.2018; 19:58 sleeping on a tree branch overhanging ~7m above the Bartola River; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 1105 mm; tail 634 mm; 161 ventral scales; 545 g; 1♂, UMMZ 247374 (RAB3160); GenBank OM801129.

Identification. We encountered one of these large, predominantly arboreal snakes. The snake we found was easily identifiable by the mostly black body, white ventral parts, and having only 10 dorsal rows of scales at midbody (Savage 2002; Köhler 2008).

***Dendrophidion percarinatum* (Cope, 1893)**
Figure 12B; Appendix Figure A68

New record. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9712, −084.3322; 4.VI.2018; 21:04; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 497 mm; tail 393 mm; 41.5 g; 1♂, UMMZ 247086 (RAB3187); GenBank OM801150.

Identification. Our individual of this medium-sized snake was easily distinguished from congeners by the scale row reduction from eight to six occurs anterior to subcaudal (Köhler 2008).

Remarks. The 16S tree is poorly resolved. The location of the Nicaraguan specimen is particularly uncertain.

***Drymarchon melanurus* (Duméril, Bibron, & Duméril, 1854)**
Figure 12C; Appendix Figure A69

New record. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.7130, −086.3656; 22.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 1600 mm; tail 325 mm; 193 ventral scales; 1250 g; UMMZ 247140 (RAB3059); GenBank OM801044.

Identification. Our individual can be identified as this species by a dark diagonal band on the neck and dark color on the ventral surface on the posterior portion of the body. Our adult specimen was brown in dorsal color, with darker brown towards the tip the tail (Wüster et al. 2001; Savage 2002).

Distribution. Our individual is the first record of this species from the Department of Nueva Segovia (Köhler 2001; Sunyer et al. 2014a; HerpetoNica 2015).

Remarks. Nicaraguan populations of this species were formerly considered a subspecies of *D. corais* (F. Boie, 1827).

***Lampropeltis abnorma* (Bocourt, 1886)**
Figure 12D; Appendix Figure A70

New record. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.7402, −086.3785; 23.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 247 mm; tail 41 mm; 233 ventral scales; 91.4 g; 1♀, UMMZ 247095 (RAB3060); GenBank OM801045.

Identification. Our individual can be identified as this species by the brightly colored red-black-yellow-black ringed pattern (although some rings were incomplete in our specimen). It can be set apart from *Micrurus* by the presence of an entire scale just forward of the cloaca and mostly divided scales on the bottom of the tail and two small pits on the tail end of each scale (Savage 2002; McCranie 2011).

Distribution. Our individual is the first record of this species from the Department of Nueva Segovia (Köhler 2001; Sunyer et al. 2014a; HerpetoNica 2015).

***Leptodrymus pulcherrimus* (Cope, 1874)**
Figure 12E; Appendix Figure A71

New records. NICARAGUA – **Dept. León** • Asososca Lake; 12.4295, −086.6620; 27.V.2018; 20:32; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 502 mm; tail 263 mm; 201 ventral scales; 20.81 g; 1♀, UMMZ 247102 (RAB3098) • Same locality; 12.4302, −086.6605; 27.V.2018; 21:05; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 623 mm; tail 340 mm; 203 ventral scales; 46.8 g; 1♀, UMMZ 247103 (RAB3099); GenBank OM801078 • Same locality; 12.3825, −086.6273; 28.V.2018; 20:26; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 532 mm; tail 275 mm; 202 ventral scales; 24.2 g; 1♀, UMMZ 247104 (RAB3103); GenBank OM801082.

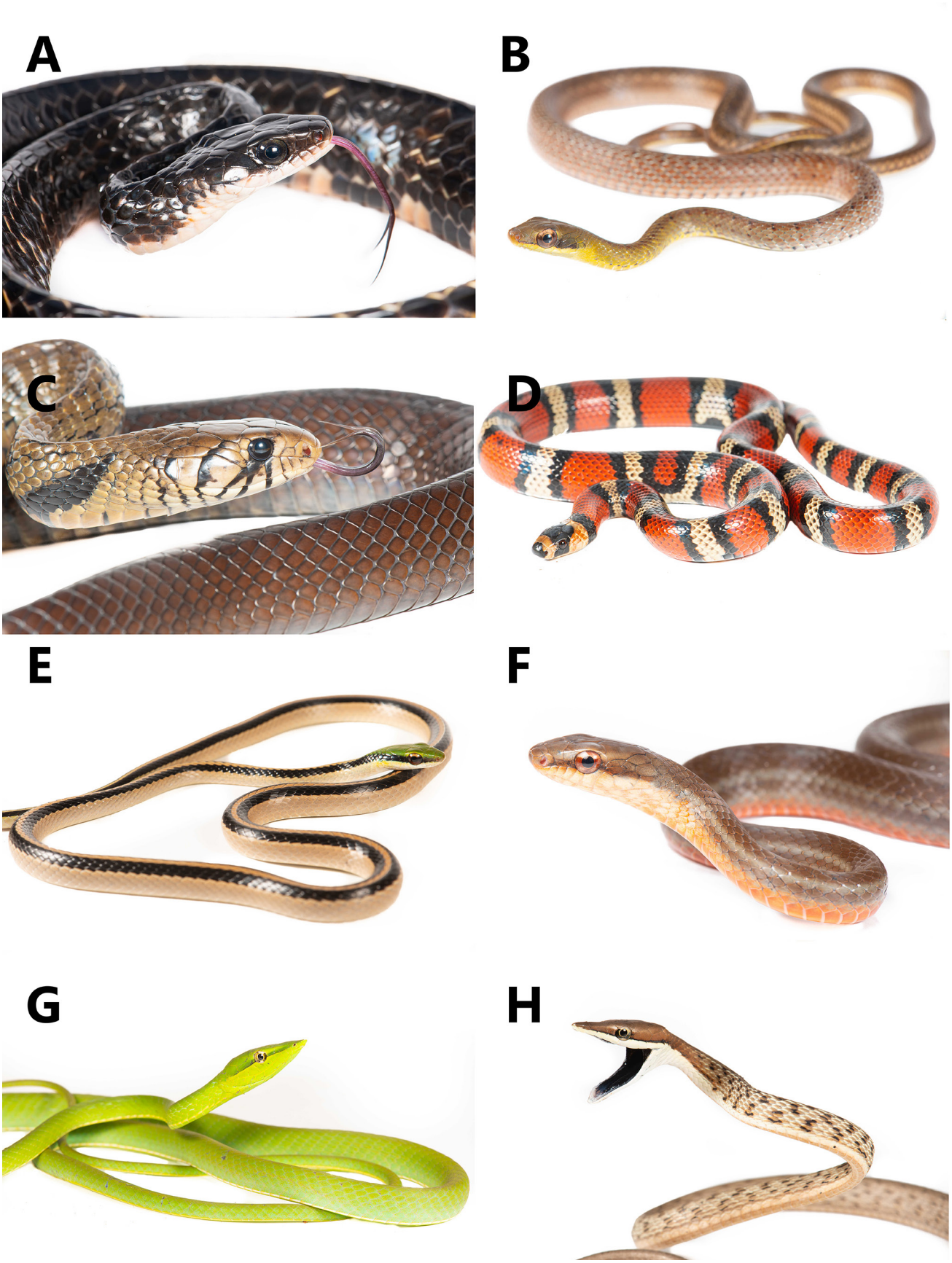

Figure 12. Species encountered during the 2018 UMMZ expedition to Nicaragua. **A.** *Chironius grandisquamis*, UMMZ 247374. **B.** *Dendrophidion percarinatum*, UMMZ 247086. **C.** *Drymarchon melanurus*, UMMZ 247140. **D.** *Lampropeltis abnorma*, UMMZ 247095. **E.** *Leptodrymus pulcherrimus*, UMMZ 247102. **F.** *Mastigodryas alternatus*, UMMZ 247106. **G.** *Oxybelis fulgidus*, UMMZ 247116. **H.** *Oxybelis koehleri*, UMMZ 247111.

Identification. This distinctive snake is the only member of the monotypic genus *Leptodrymus* Amaral, 1927. Our individuals were characterized by the presence of three postocular scales, dorsally bright-green head, bright-red tongue, and a cream dorsal stripe flanked by black on either side, all of which is diagnostic for this species (Savage 2002; McCranie 2011).

***Mastigodryas alternatus* (Bocourt, 1884)**
Figure 12F; Appendix Figure A72

New record. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 10.9716, −084.3371; 4.VI.2018; 19:09; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 756 mm; tail 285 mm; 117.1 g; 1♂, UMMZ 247106 (RAB3191); GenBank OM801154.

Identification. Our individual was a moderately sized snake easily identifiable as this species from other similar ones by having a divided anal scale, 17 scale rows at mid-body, 15 scale rows anterior to the vent, and two postocular scales (Savage 2002; McCranie 2011; Montingelli et al. 2019).

***Oxybelis fulgidus* (Daudin, 1803)**
Figure 12G; Appendix Figure A73

New record. NICARAGUA – **Dept. León** • Asososca Lake; 12.4276, −086.6608; 26.V.2018; 19:30; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 278 mm; tail 147 mm; 207 ventral scales; 40.3 g; 1♀, UMMZ 247116 (RAB3079); GenBank OM801060.

Identification. Our individual was unmistakably distinguished from other species in the genus by its uniform bright green dorsal coloration and yellow-brown ventral coloration. It has 17 rows of dorsal scales at midbody and divided anal scute. The long and pointy snout with characteristic green tongue are also diagnostic (Köhler 2001, 2008; Savage 2002).

***Oxybelis koehleri* Jadin, Blair, Orlofske, Jowers, Rivas, Vitt, Ray, Smith, & Murphy, 2020**
Figure 12H; Appendix Figure A74

New records. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.7056, −086.3611; 22.V.2018; 21:00; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 355 mm; tail 210 mm; 117 ventral scales; 6.91 g; UMMZ 247111 (RAB3056); GenBank OM801041 – **Dept. León** • Puerto Momotombo; 12.3833, −086.6286; 28.V.2018; 20:04; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 725 mm; tail 438 mm; 186 ventral scales; 30.8 g; 1♂, UMMZ 247112 (RAB3101); GenBank OM801080 • Same locality; 12.3805, −086.6329; 28.V.2018; 18:05; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 865 mm; tail 508 mm; 189 ventral scales; 73.1 g; 1♀, UMMZ 247113 (RAB3102); GenBank OM801081 – **Dept. Rio San Juan** • Refugio Bartola; 10.9720, −084.3381; 01.VI.2018; 19:07; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 710 mm; tail 495 mm; 193 ventral scales; 31.1 g; 1♀, UMMZ 247114 (RAB3143); GenBank OM801115 • Same locality; 10.9711, −084.3350; 4.VI.2018; 19:36; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 747 mm; tail 557 mm; 27.5 g; 1♂, UMMZ 247115 (RAB3189); GenBank OM801152.

Identification. Our individuals were easily identifiable as this speciesand different from other in the genus in Central America by the brown or greyish head and body. Our individuals lacked the small dark flecks in the tail that are sometimes reddish in some specimens of this species (Savage 2002; Köhler 2008; McCranie 2011).

Distribution. Our individuals from Mogotón and Momotombo are recorded from the Departments of Nueva Segovia and León, respectively (Köhler 2001; Sunyer et al. 2014a; HerpetoNica 2015).

Remarks. When manipulated, all our specimens displayed a defensive pose, with mouth wide open showing a black lining (Savage 2002; Köhler 2008; McCranie 2011).

***Phrynonax poecilonotus* (Günther, 1858)**
Figure 13A; Appendix Figure A75

New record. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9729, −084.3390; 6.VI.2018; 10:00; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 1150 mm; tail 451 mm; 294 g; 1♂, UMMZ 248407 (RAB3207); GenBank OM801166.

Identification. The coloration of this species is highly variable among individuals and between the juvenile and adult stages. Our specimen was an adult and easily distinguished by having its dorsal scales arranged in 21–25 oblique rows, with the scale rows near the spine keeled. It has a single anal scale, a single loreal, and the eyes are separated by at least two scales from the nasal scale. The dorsal portion of the head is greenish brown with a sharp transition to bright yellow just above the supralabials and lower jaw (Savage 2002; McCranie 2011).

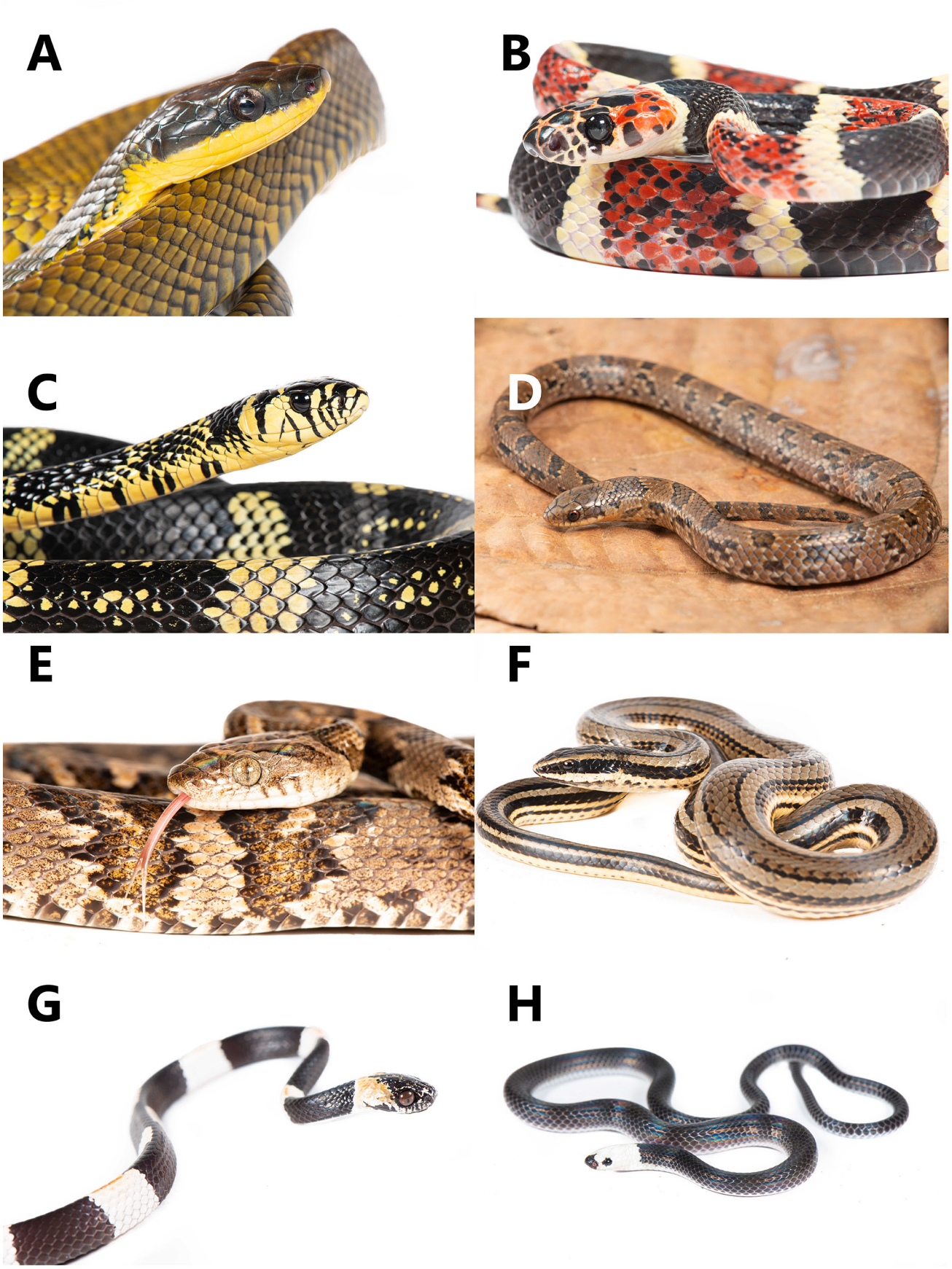

Figure 13. Species encountered during the 2018 UMMZ expedition to Nicaragua. **A.** *Phrynonax poecilonotus*, UMMZ 248407. **B.** *Rhinobothryum bovallii*, UMMZ 247120. **C.** *Spilotes pullatus*, UMMZ 247125. **D.** *Stenorrhina degenhardtii*, UMMZ 247126. **E.** *Trimorphodon quadruplex*, UMMZ 247129. **F.** *Conophis lineatus*, UMMZ 247084. **G.** *Dipsas articulata*, UMMZ 248395. **H.** *Enuliophis sclateri*, UMMZ 247091.

***Rhinobothryum bovallii* (Andersson, 1916)**
Figure 13B; Appendix Figure A76

New record. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9707, −084.3338; 1♂, UMMZ 247120 (RAB3018).

Remarks. This individual is a new country record and was not included as part of the Nicaraguan herpetofauna by Sunyer (2014). This record was published as a separate article by Martínez-Fonseca et al. (2019). We include the specimen here for sake of completeness since it was collected during this expedition.

***Spilotes pullatus* (Linnaeus, 1758)**
Figure 13C; Appendix Figure A77

New record. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.6856, −086.3650; 23.V.2018; 11:40 moving fast through the road and climbing tree, easily moving among several tress in a few minutes; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 1670 mm; tail 600 mm; 121 ventral scales; 900 g; 1♂, UMMZ 247125 (RAB3057); GenBank OM801042.

Identification. Our individual was easily identifiable by its size and agility. The black-and-yellow irregular pattern on the body is like no other species in the area. Several dark marks radiate downwards from the eye (Savage 2002; Köhler 2008; HerpetoNica 2015).

Remarks. This species is known by Spanish name "voladora," which means "flying one," because of its arboreal nature and agility through vegetation.

***Stenorrhina degenhardtii* (Berthold, 1846)**
Figure 13D; Appendix Figure A78

New record. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.7466, −086.3808; 19.V.2018; 12:26; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 226 mm; tail 55 mm; 152 ventral scales; 9.76 g; UMMZ 247126 (RAB3037); GenBank OM801025.

Identification. Our individual was easily recognizable as this species by its small, robust body with blotched ventral scales and a variable dorsal pattern. Our individual was identified by its upturned snout with an enlarged rostral scale. The scales immediately behind the rostral but in front of the nostrils are fused into a single unit. The only other member on the genus that occurs in Nicaragua has longitudinal stripes and more than 159 ventral scales (Savage 2002; Köhler 2008).

Distribution. Our individuals are the first of the species from the Department of Nueva Segovia (Köhler 2001; Sunyer et al. 2014a; HerpetoNica 2015).

***Trimorphodon quadruplex* Smith, 1941**
Figure 13E; Appendix Figure A79

New records. NICARAGUA – **Dept. León** • Asososca Lake; 12.4272, −086.6613; 26.V.2018; 19:30; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 865 mm; tail 157 mm; 262 ventral scales; 88.1 g; 1♀, UMMZ 247129 (RAB3078) • Same locality; 12.4275, −086.6608; 26.V.2018; around 19:30; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 842 mm; tail 199 mm; 252 ventral scales; 125.1 g; 1♀, UMMZ 247130 (RAB3085); GenBank OM801066.

Identification. Members of the genus *Trimorphodon* have a distinctive dark arc or chevron on the back of the head, pointing toward the nose and continuing down behind the jaw line. Our individual can be further identified as belonging to this species by the light patches contained within the dark blotches along their dorsal surface, which make an irregular "bullseye" pattern (Devitt et al. 2008; Köhler 2008).

Distribution. Our individuals are the first of the species from the Department of León (Köhler 2001; Sunyer et al. 2014a; HerpetoNica 2015).

Family Dipsadidae

***Conophis lineatus* (Duméril, Bibron, & Duméril, 1854)**
Figure 13F; Appendix Figure A80

New records. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.6844, −086.3658; 25.V.2018; 08:40; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 631 mm; tail 195 mm; 160 ventral scales; 118.5 g; 1♂, UMMZ 247084 (RAB3072); GenBank OM801055 – **Dept. León** • Asososca Lake; 12.4281, −086.6612; 26.V.2018; 15:00; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 602 mm; tail 132 mm; 173 ventral scales; 69.9 g; 1♀, UMMZ 247085 (RAB3087); GenBank OM801068.

Identification. Our specimens of this medium-sized, heavy-bodied but fast snake can be identified as member of this species by its sandy-brown background color with two black lateral stripes running from nose to tail (Savage 2002). The rostral scale is curved upwards posteriorly and the 4th and 5th supralabials are in contact with the eye, a trait distinctive to this species (Köhler 2008; McCranie 2011).

Distribution. Our individual is the first of the species from the Department of Nueva Segovia (Köhler 2001; Sunyer et al. 2014a; HerpetoNica 2015).

Remarks. This is one of the most venomous dipsadine snakes in Nicaragua (Wallach et al. 2014).

Dipsas articulata **(Cope, 1868)**
Figure 13G; Appendix Figure A81

New records. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9763, −084.3400; 6.VI.2018; 20:55; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 299 mm; tail 125 mm; 5.72 g; 1♀, UMMZ 248395 (RAB3214) • Same locality; 10.9776, −084.3337; 9.VI.2018; 19:57; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 384 mm; tail 156 mm; 9.8 g; 1♀, UMMZ 247087 (RAB3240); GenBank OM801192.

Identification. Our specimen of this small, arboreal snake with large eyes has thick black bands alternating with white to light tan bands. It can be further distinguished from other species in the genus by the presence of six almost rectangular scales arranged in two rows in the chin. They also lacked preocular scales (Savage 2002; Köhler 2008; McCranie 2011)

Enuliophis sclateri **(Boulenger, 1894)**
Figure 13H; Appendix Figure A82

New record. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9787, −084.3369; 6.VI.2018; 20:07; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 177 mm; tail 122 mm; 4.03 g; 1♂, UMMZ 247091 (RAB3215); GenBank OM801172.

Identification. Our specimen of this small snake was easily identifiable as this species by the contrasting white neck saddle that touches the eyes and dark-blue body, blunt snout, and 15 dorsal scale rows a pair of apical pits in most dorsal scales (Savage 2002; McCranie 2011).

Remarks. We encountered this snake at night, moving on a dead stump 1.5 m above the ground in an upland forest. The snake is generally considered fossorial, so finding it above ground was unexpected (McCranie 2004). However, the closely related *E. flavitorques* (Cope, 1869) has been observed climbing trees, likely in pursuit of termites or arboreal lizard eggs (Brown et al. 2018).

Enulius flavitorques **(Cope, 1868)**
Figure 14A; Appendix Figure A83

New records. NICARAGUA – **Dept. León** • Asososca Lake; 12.4289, −086.6631; 27.V.2018. 20:09 found under a log; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 262 mm; tail 130 mm; 188 ventral scales; 5.44 g; 1♂, UMMZ 247088 (RAB3093) • Same locality; 12.4272, −086.6613; 29.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 186 mm; tail 78 mm; 193 ventral scales; 1.88 g; 1♀, UMMZ 247089 (RAB3112); GenBank OM801090.

Identification. Our two individuals of this small, thin, fossorial snake were easily identified as members of this species by their black background color with a light-yellow saddle across the back of their neck and behind their eyes. They also had a shovel-shaped snout and 17 dorsal scale rows, which are characteristic of this species (Savage 2002; McCranie 2011).

Imantodes cenchoa **(Linnaeus, 1758)**
Figure 14B; Appendix Figure A84

New records. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9712, −084.3352; 1.VI.20181; 19:58; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 658 mm; tail 321 mm; 257 ventral scales; 11.1 g; ♂, UMMZ 247093 (RAB3133); GenBank OM801105 • Same locality; 10.9719, −084.3341; 1.VI.2018; 20:25; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 536 mm; tail 89 mm; 9.7 g; 1♀, UMMZ 247094 (RAB3137); GenBank OM801109 • Same locality; 10.9717, −084.3330; 4.VI.2018; 21:20; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 254 mm; tail 110 mm; 1.46 g; UMMZ 248399 (RAB3193); GenBank OM801156.

Identification. Our individuals can be distinguished from other snakes by their long, thin neck, large head with protruding eyes, and light brown background color with darker saddles. It can be distinguished from all congeners in Nicaragua by the enlarged scale row with scales 3–4 times the size of adjacent rows along its spine (Savage 2002; Köhler 2008; McCranie 2011).

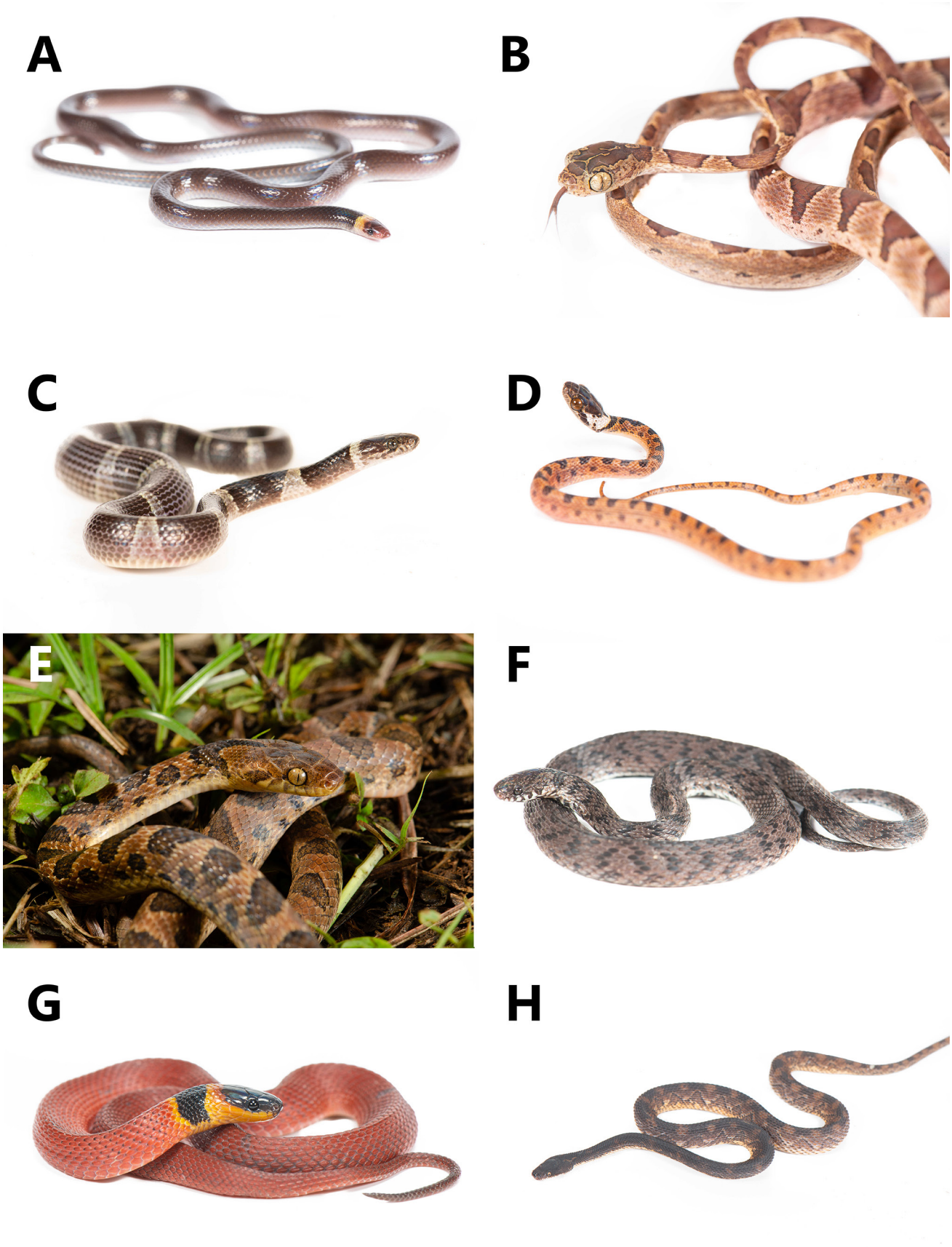

Figure 14. Species encountered during the 2018 UMMZ expedition to Nicaragua. **A.** *Enulius flavitorques*, UMMZ 247088. **B.** *Imantodes cenchoa*, UMMZ 247093. **C.** *Leptodeira nigrofasciata*, UMMZ 247096. **D.** *Leptodeira polysticta*, UMMZ 247100. **E.** *Leptodeira rhombifera*, uncollected specimen from Santa Teresa, Carazo department. **F.** *Ninia maculata*, UMMZ 247107. **G.** *Ninia sebae*, UMMZ 247110. **H.** *Nothopsis rugosus*, UMMZ 248404.

Remarks. We encountered many of these arboreal snakes at Refugio Bartola making it the most commonly found snake at the site.

***Leptodeira nigrofasciata* (Günther, 1868)**
Figure 14C; Appendix Figure A85

New records. NICARAGUA – **Dept. León** • Asososca Lake; 12.4281, −086.6612; 27.V.2018; 10:30; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 174 mm; tail 48 mm; 169 ventral scales; 5.2 g; UMMZ 247096 (RAB3080); GenBank OM801061 • Same locality; 12.4272, −086.6613; 29.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 321 mm; tail 78 mm; 169 ventral scales; 1♀, UMMZ 247097 (RAB3110); GenBank OM801088.

Identification. Our individuals were easily identifiable as this species by the black-and-white bands throughout the body and the vertical pupils. It is the only member of the genus in Nicaragua with this color pattern and 19 rows of scales at midbody (Savage 2002; Köhler 2008).

***Leptodeira polysticta* (Günther, 1895)**
Figure 14D; Appendix Figure A86

New records. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9776, −084.3337; 3.VI.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 654 mm; tail 179 mm; 113.2 g; 1♀, UMMZ 247099 (RAB3176); GenBank OM801139 • Same locality; 10.9741, −084.3392; 7.VI.2018; 18:10; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 158 mm; tail 49 mm; 1.35 g; 1♂, UMMZ 247100 (RAB3227); GenBank OM801183 • Same locality; 8.VI.2018; 21:15; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 574 mm; tail 161 mm; 57.2 g; 1♀, UMMZ 247101 (RAB3232).

Identification. Our individuals were easily identified from other similar-looking brown cat-eyed snakes with dark blotches by the lack of pattern on the ventral surface and separation between markings on the neck and the first dark blotch (Savage 2002; Barrio-Amorós 2019).

Remarks. In Nicaragua, the taxon was formerly known as *L. septentrionalis* Kennicott, 1859 (Daza et al. 2009; Barrio-Amorós 2019).

***Leptodeira rhombifera* (Günther, 1872)**
Figure 14E; Appendix Figure A87

New record. NICARAGUA – **Dept. Carazo** • Tecomapa; 11.6492, −086.2534; 12.VI.2018; JGMF, PAC leg.; SVL 665 mm; tail 190 mm; 169.5 g; 1♀, UMMZ 247098 (RAB3241); GenBank OM801193.

Identification. Our individual was identified in the field as this species by markings on the nape of the neck that connect to the dark blotching along the dorsal surface (Savage 2002; Barrio-Amorós 2019).

Remarks. This specimen was collected opportunistically during transit between our main study sites in the lowland dry forest. The taxon may be synonymous with *L. annulata* (Linnaeus, 1758), which ranges from Guatemala to Panama. It forms a monophyletic clade within the paraphyletic *L. septentrionalis* (Daza et al. 2009; Barrio-Amorós 2019).

***Ninia maculata* (Peters, 1861)**
Figure 14F; Appendix Figure A88

New record. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.7517, −086.3890; 24.V.2018; 11:46; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 247 mm; tail 65 mm; 125 ventral scales; 5.8 g; 1♀, UMMZ 247107 (RAB3069); GenBank OM801053.

Identification. Our individual of this small, cryptic, ground-dwelling snake was identified as this species by the variable dorsal pattern of black saddles on a dark brown background. It also showed a strong black and white banding on the ventral surface which separates it from congeneric species in Nicaragua (Savage 2002; Köhler 2008).

Remarks. This individual was found at 1570 m and represents a new altitudinal record for the species in Nicaragua (McCranie et al. 2019). The individual also displayed thanatosis, or death feigning, when we found it, a behavior that has been recently recorded by other authors (Fuentes Magallón et al. 2021). DNA evidence shows that Guatemalan *N. maculata* may be more closely related to Mexican *N. pavimentata* (Bocourt, 1883) than they are to Costa Rican *N. maculata* (Ingrasci 2011).

Distribution. Our individual is the first one of the species from the Department of Nueva Segovia (Köhler 2001; Sunyer et al. 2014a; HerpetoNica 2015).

***Ninia sebae* (Duméril, Bibron, & Duméril, 1854)**
Figure 14G; Appendix Figure A89

New records. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.7402, −086.3785; 17.V.2018; 18:45; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 232 mm; tail 65 mm; 152 ventral scales; 4.64 g; 1♂, UMMZ 247109 (RAB3022); GenBank OM801011 • Same locality; 13.7400, −086.3781; 17.V.2018; 19:01; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 191 mm; tail 45 mm; 149 ventral scales; 4.35 g; 1♀, UMMZ 247110 (RAB3023); GenBank OM801012 – **Dept. Rio San Juan** • Refugio Bartola; 10.9764, −084.3355; 3.VI.2018; 21:05; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 210 mm; tail 70 mm; 4.59 g; 1♂, UMMZ 248403 (RAB3178); GenBank OM801141.

Identification. Our individuals of this small, red-brown snake were easily identifiable as this species by the presence of a black cap on the head which does not completely cover the parietals. In this species and our individuals, the body shows variable patterns of black and yellow on the red background but our specimens that pattern was faint, and animals were mostly evenly dark red (Savage 2002; Köhler 2008).

Remarks. The phylogeography of *N. sebae* in Central America is not fully resolved, but some mitochondrial and nuclear gene trees indicate that Mexican lineages are the most deeply divergent (Ingrasci 2011).

Distribution. Our individuals from Mogotón are the first ones of this species from the Department of Nueva Segovia (Köhler 2001; Sunyer et al. 2014a; HerpetoNica 2015).

***Nothopsis rugosus* Cope, 1871**
Figure 14H; Appendix Figure A90

New records. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9714, −084.3329; 4.VI.2018; 21:15; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 257 mm; tail 102 mm; 6.41 g; 1♀, UMMZ 248404 (RAB3188); GenBank OM801151.

Identification. Our individual was easily recognized as this species by the rough dorsal scales, including irregular-shaped scales on the dorsal portion of the head, giving it an almost beaded appearance. The dorsal pattern is composed of diamond-shaped dark blotches on a lighter background which is also an important diagnostic characteristic for the species (Savage 2002; Köhler 2008).

Remarks. Köhler (2008) remarked that there is little information available on this rarely seen species. Our individual was actively moving on top of the leaf litter and did not attempt to bite when it was picked up, which is similar to other observations (Köhler and Schmidt 2001).

***Rhadinella kinkelini* (Boettger, 1898)**
Figure 15A; Appendix Figure A91

New records. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.7452, −086.3787; 17.VI.2018; 20:24; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 222 mm; tail 103 mm; 134 ventral scales; 4.61 g; 1♂, UMMZ 247117 (RAB3027); GenBank OM801015 • Same locality; 13.7430, −086.3814; 18.V.2018; 19:50; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 187 mm; tail 74 mm; 142 ventral scales; 3.16 g; 1♀, UMMZ 247118 (RAB3035); GenBank OM801023 • Same locality; 13.7402, −086.379; 25.V.2018; around 17:00; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 173 mm; tail 82 mm; 136 ventral scales; 2.7 g; 1♂, UMMZ 247119 (RAB3074); GenBank OM801057.

Identification. Our individuals were distinguished from other similar congeners by the presence of a black cap on the head with brown and black dorsal and lateral stripes along the body. All individuals had 17 scales at midbody, dark-edged supralabial scales, and a curving mark on the rostral scales, all of which is diagnostic for this species (Savage 2002; Köhler and Sunyer 2008).

Distribution. Our individuals from Mogotón are the first ones of this species from the Department of Nueva Segovia (Köhler 2001; Sunyer et al. 2014a; HerpetoNica 2015).

***Sibon nebulatus* (Linnaeus, 1758)**
Figure 15B; Appendix Figure A92

New records. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9720, −084.3381; 1.VI.2018; 19:11; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 305 mm; tail 10 mm; 185 ventral scales; 8.46 g; 1♀, UMMZ 248409 (RAB3135); GenBank OM801107 • Same locality; 10.9716, −084.3369; 1.VI.2018; 19:25; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 320 mm; tail 114 mm; 179 ventral scales; 8.96 g; 1♂, UMMZ 248410 (RAB3138); GenBank OM801110.

Identification. Our individuals, unlike other species in the same genus, had 15 dorsal scales throughout the body and the first pair of infralabials are in contact posterior to mental shield (McCranie 2011). All individuals had diffused black saddles extending onto the ventral surface and surrounded by a white border on a grey background, which is typical for this species (Savage 2002).

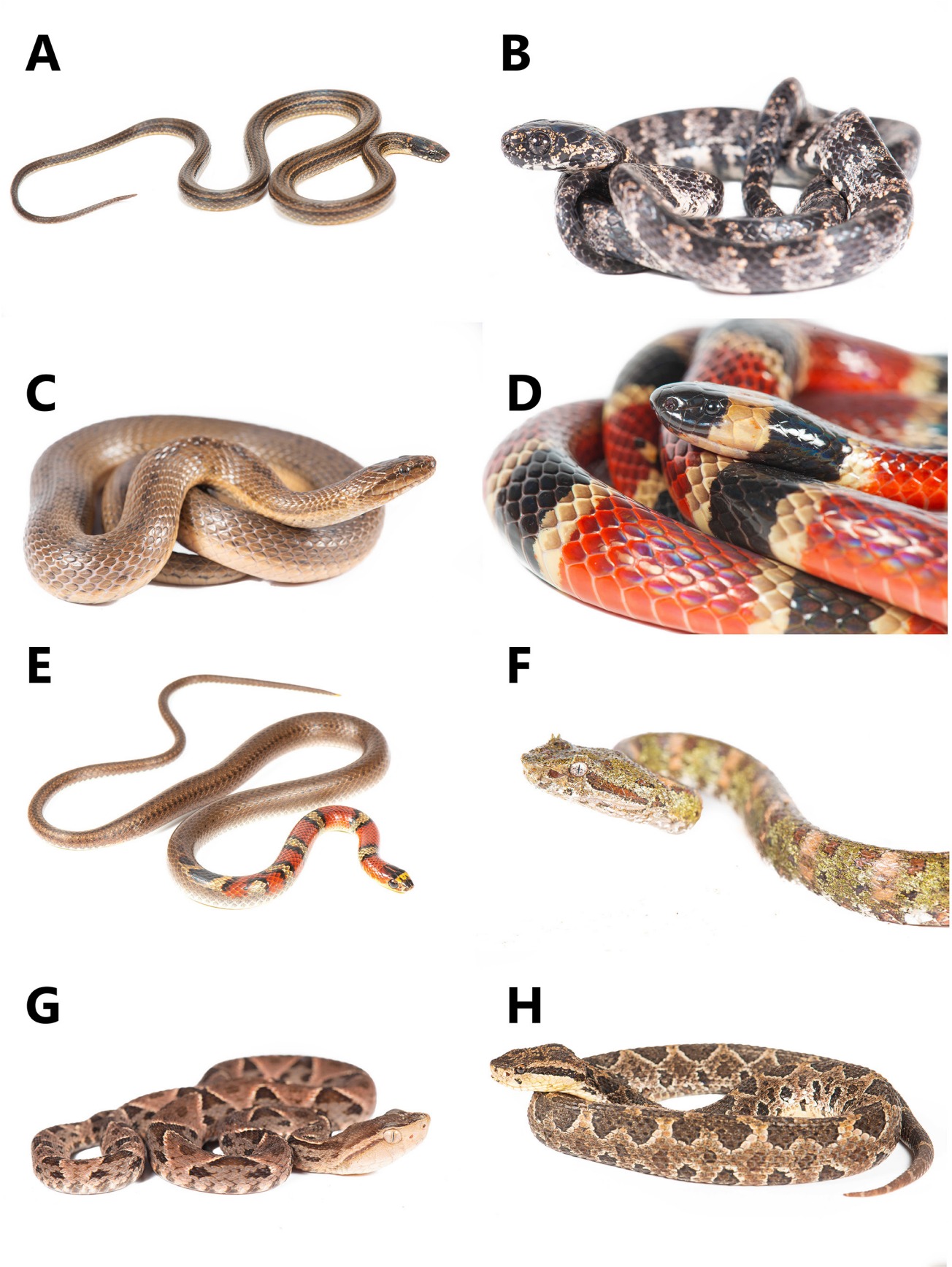

Figure 15. Species encountered during the 2018 UMMZ expedition to Nicaragua. **A.** *Rhadinella kinkelini*, UMMZ 247117. **B.** *Sibon nebulatus*, UMMZ 248410. **C.** *Tretanorhinus nigroluteus*, UMMZ 247128. **D.** *Micrurus nigrocinctus*, UMMZ 247142. **E.** *Scaphiodontophis annulatus*, UMMZ 247121. **F.** *Bothriechis schlegelii*, UMMZ 247133. **G.** *Bothrops asper*, UMMZ 247134. **H.** *Metlapilcoatlus indomitus*, UMMZ 247136.

***Tretanorhinus nigroluteus* Cope, 1862**
Figure 15C; Appendix Figure A93

New record. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9709, −084.3319; 2.VI.2018; 20:58 resting on submerge tree trunk in the Bartola River 50 cm below the surface and about 6 m from shore; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 176 mm; tail 88 mm; 133 ventral scales; 68.2 g; 1♂, UMMZ 247128 (RAB3158); GenBank OM801127.

Identification. Our individual had a distinctive orange ventral surface, with a dark brown dorsal surface with small black saddles. Also, as an aquatic snake, our individual clearly had nostrils on the top of the snout to facilitate breathing while swimming (Savage 2002).

Remarks. Although associated with freshwater, this species has successfully colonized islands along the Caribbean coast of Central America (Barquero and Arguedas 2019).

Family Elapidae

***Micrurus nigrocinctus* (Girard, 1854)**
Figure 15D; Appendix Figure A94

New records. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.7056, −086.3612; 22.V.2018; 19:30; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 717 mm; tail 119 mm; 1♀, UMMZ 247142 (RAB3053); GenBank OM801039 – **Dept. Carazo** • Municipio de Santa Teresa, Aguas Calientes; 11.6267, −086.1977; 12.VI.2018; JGMF, PAC leg.; SVL 651 mm; tail 83 mm; 1♀, UMMZ 247143 (RAB3242).

Identification. Our individuals are clearly members of *Micrurus*, identified by their cylindrical body and tail, lack of evident neck behind the skull, small black eyes, and smooth scales (Savage 2002; Köhler 2008; HerpetoNica 2015). They were easily identified from the syntopic *M. alleni* Schmidt, 1936 by the black coloration on the head which does not extend far past the eyes (Savage 2002).

Remarks. The most widely distributed coral snake in Nicaragua and Central America. UMMZ 247143 was encountered in Río Escalante-Chacocente Wildlife Reserve in lowland dry forest at dusk, near the Pacific coast of the country. *Micrurus nigrocinctus moskitensis* is recognized to species level in Costa Rica and other countries but apparently is greatly hybridized with *M. n. nigrocinctus* in southeastern Nicaragua (Sunyer 2009; Sunyer and Köhler 2010).

Family Sibynophiidae

***Scaphiodontophis annulatus* (Duméril, Bibron, & Duméril, 1854)**

Figure 15E; Appendix Figure A95

New records. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.7266, −086.3766; 17.V.2018; 11:15; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 402 mm; tail 227 mm; 153 ventral scales; 32.7 g; 1♀, UMMZ 247121 (RAB3019); GenBank OM801009 • Same locality; 13.7427, −086.3790; 17.V.2018; 20:00; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 286 mm; tail 232 mm; 139 ventral scales; 20.1 g; 1♀, UMMZ 247122 (RAB3025).

Identification. Our individuals were easily identified by their uniformly brown background color, with red, yellow, and black triad bands occurring in sections along their length. All our individuals show tricolor banding along <¼ of the body length from the head; this is diagnostic of this species. None of our individuals show intermittent patches of the pattern along their bodies as is documented for other specimens of the species. The remaining posterior part of the bodies showed three longitudinal dotted lines (Savage 2002; Köhler 2008; McCranie 2011). This species is one of the few snakes that, when threatened, lose their tails, in a manner similar to lizards (Savage and Slowinski 1996), but the tails of all our collected specimens are complete.

Remarks. This species was not officially recorded from Nicaragua by Sunyer (2014), and our specimens were the first known from the county record at the time of their collection. However, this species was later reported from sightings in Nueva Segovia and Jinotega departments (Salazar-saavedra et al. 2018).

Family Viperidae

***Bothriechis schlegelii* (Berthold, 1846)**
Figure 15F; Appendix Figure A96

New record. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9757, −084.3239; 7.VI.2018; 17:30 resting on a branch overhanging the water on a small tributary of the Bartola River; DN, EPW, GGP, IAH, IVM,

JCLM, JGMF, MAFM, MRG leg.; SVL 445 mm; tail 84 mm; 27.4 g; 1♀, UMMZ 247133 (RAB3224); GenBank OM801180.

Identification. Our individual was easily distinguished from other vipers in Nicaragua by the spiky "eyelash" scales above the eyes. The body pattern was mostly green, with irregular patches of dark red or red-brown and white. A postocular stripe extending to the neck was very evident. (Savage 2002).

Remarks. This species is an emblematic arboreal viper of the tropical wet forests of Central America with several color phases that can be found in the country.

***Bothrops asper* (Garman, 1884)**
Figure 15G; Appendix Figure A97

New records. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9759, −084.3398; 6.VI.2018; 21:13; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 389 mm; tail 58 mm; 22.3 g; 1♀, UMMZ 247134 (RAB3213); GenBank OM801171 • Same locality; 10.9776, −084.3337; 9.VI.2018; 21:00; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 685 mm; tail 107 mm; 105.5 g; 1♀, UMMZ 247135 (RAB3233); GenBank OM801187.

Identification. Our individuals can be identified as members of this large viper species by their dorsal pattern of dark triangular blotches with light outlines. No other species in the genus occur north of Panama (Savage 2002; HerpetoNica 2015).

Remarks. UMMZ 247134 was a juvenile and showed a paler-than-the-body tail tip used for caudal luring (Savage 2002). In Nicaragua, the species occurs in both wet and transition zones to dry forest in Nicaragua (Martínez-Fonseca et al. 2016). Recent phylogeographic work groups Nicaraguan animals with Costa Rican animals. However, an extensive sampling gap occurs in Nicaragua. Further sampling of this species across the country will refine our understanding of the phylogeographic patterns of this species (Saldarriaga-Córdoba et al. 2017).

***Metlapilcoatlus indomitus* Campbell, Frost, & Castoe, 2019**
Figure 15H; Appendix Figure A98

New record. NICARAGUA – **Dept. Nueva Segovia** • Las Brisas del Mogotón; 13.7402, −086.379; 22.V.2018; DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG leg.; SVL 419 mm; tail 62 mm; 141 ventral scales; 65 g; 1♂, UMMZ 247136 (RAB3052); GenBank OM801038.

Identification. Our individual was a stocky-bodied snake with thermosensory pits between the eye and the nostrils, long and narrow supraocular scales, and a well-defined pattern of diamond-shaped blotches throughout the body. All dorsal scales in the head are keeled. The individual was easily distinguished from the other congeners in Nicaragua by larger number of ventral scales (compared to 114-130 in *M. mexicanus*), and the dark coloration present on the posterior third of the venter (Köhler 2008, Smith and Ferrari-Castro 2008, McCranie 2011). Another species that might superficially resemble this species that is known to occur in the area is *Cerrophidion wilsoni* Jadin, Townsend, Castoe & Campbell, 2012, but this species has large supraocular plates, a lighter body, and less evident pits.

Distribution. The species was originally described as endemic to Honduras but is now known to occur in Nicaragua. This specimen was brought to us deceased by workers of the coffee plantations in Las Brisas del Mogotón. The specimen was found actively moving near a stream. Previous to this specimen, a photo voucher of this species was erroneously reported from same general locality (Cerro Mogotón, Nueva Segovia department) as *Cerrophidion wilsoni* in lapsus (Sunyer et al. 2017). This species was not included as part of the Nicaraguan herpetofauna by Sunyer (2014) but was later recorded by Fernández et al. (2017). UMMZ 247136 represents the first official record and specimen of *M. indomitus* from the country, and it represents a range extension south from the nearest previously known occurrence in Honduras.

***Porthidium nasutum* (Bocourt, 1868)**
Figure 16; Appendix Figure A99

New record. NICARAGUA – **Dept. Rio San Juan** • Refugio Bartola; 10.9776, −084.3337; SVL 297 mm; tail 45 mm; 19.1 g; 8.VI.2018; 21:59; 1♂, UMMZ 247139 (RAB3230); GenBank OM801185.

Identification. Our individual was easily recognized as this species by the proboscis (elongated and elevated rostral scale resembling a horn or "hog nose") at the tip of the nose. Our individual had a whiter or light-colored dorsal line starting at the neck and running along the body and most of the tail which is a diagnostic feature of many members of this genus (Savage 2002; Köhler 2008).

Remarks. Previous genetic work has shown a single Honduran individual of this species "nested" among Costa Rican specimens (Castoe et al. 2005).

Figure 16. Individual of *Porthidium nasutum* (UMMZ 247139) collected during the 2018 UMMZ expedition to Nicaragua.

DISCUSSION

Our 2018 expedition contributed a total of 23 new departmental records for Nicaragua, one of which is also a new country record. From our work at Las Brisas del Mogotón, we recorded two amphibian and 16 reptile new departmental records for Nueva Segovia. At our Asososca lake site, we recorded four new departmental records for León department and our Bartola site yielded one new departmental record for Río San Juan. Additionally, we contributed the first official record and voucher of *Metlapilcoatlus indomitus* in Nicaragua. This disparity on the number of new records among departments is a consequence of the departments of Rio San Juan and those in the Pacific region of Nicaragua having had more studies (e.g., Köhler 2001; Sunyer and Pierson 2015). In comparison, the northern highlands and the northern Caribbean regions of the country have historically been understudied.

Nicaragua is undersampled for herpetological diversity relative to other Central American countries. The gap is most apparent in the eastern area of the country, which has historically been less populated and is difficult to access despite recent development. Therefore, many species are presumed not to occur in this area when, in reality, they might. A few of the species we discuss above show IUCN range polygons with a gap in lowland eastern Nicaragua, despite their documented occurrence in similar habitats in Honduras and Costa Rica. Species showing this pattern include the frogs *Incilius coniferus*, *Teratohyla pulverata*, *Cochranella granulosa*, *Sachatamia albomaculata*, *Craugastor laevissimus*, *Smilisca sordida*, and *Pristimantis cerasinus*. The snakes *Enuliophis sclateri* and *Porthidium nasutum* also have this pattern. In addition to IUCN polygons, widely used occurrence databases, such as GBIF, have less sampling density in eastern Nicaragua. Surveys in this area should thus be prioritized to better understand biogeographic and ecological patterns of reptiles and amphibians.

The sparse sampling of reptile and amphibian taxa across Nicaragua is a problem for region-wide phylogeography and species delimitation. Without sampling in Nicaragua, studies that find genetic and morphological differentiation between Costa Rican and Honduran populations of a species cannot differentiate between a sharp genetic break between their samples or gradual genetic differentiation (Savage 2001). Sampling in Nicaragua, especially the under-sampled Caribbean region of the country, is critical to understanding the ecology and evolution not only of reptiles and amphibians, but also of other taxa like mammals and plants across Central America (Stevens et al. 2001; Reid 2009; Martínez-Fonseca et al. 2020).

ACKNOWLEDGEMENTS

We want to thank property owners and managers Sandra Castrillo (Refugio Bartola), Ramón Jiménez and family (Las Brisas del Mogotón), and Israel Molina Díaz (Laguna Asososca and Momotombo). We also thank Heyddy Calderón Palma, Indiana Montoya, and René Castellón from the Ministerio de Ambiente y Recursos Naturales (MARENA) for their help obtaining research permits. We thank Nathalie Citeli, Manuella Folly, Gunther Köhler, Milton Salazar-Saavedra, and Gregory Schneider for the valuable revisions to the manuscript. We additionally would like to thank Gregory Schneider again for his assistance in accessioning these specimens to the UMMZ collections and confirming species identifications. Finally, we want to thank the Biodiversity Laboratory at University of Michigan for conducting all the genetic sequencing of our samples.

ADDITIONAL INFORMATION

Conflict of interest
The authors have declared that no competing interests exist.

Ethical statement
No ethical statement was reported.

Funding
This research was supported by funds to IAH from American Society of Ichthyologists and Herpetologists Gaige Fund Award, University of Michigan Rackham International Research Award, National Science Foundation Graduate Research Fellowship Program, and the National Institute of Allergy and Infectious Diseases, Grant/Award Number: T32II45821, as well as by funds from the University of Michigan and UM Museum of Zoology to ADR

Author contributions
Conceptualization: JGMF, IAH. Data curation: JGMF, IAH, JS. Formal analysis: IAH, JGMF. Funding acquisition: ARDR, IAH. Investigation: DN, EPW, GGP, IAH, IVM, JCLM, JGMF, MAFM, MRG, PAC. Supervision: ARDR. Writing – original draft: DN, EPW, GGP, IAH, IVM, JGMF, MRG, PAC. Writing – review and editing: ARDR, EPW, IAH, JGMF.

Author ORCID iDs
José Gabriel Martínez-Fonseca https://orcid.org/0000-0002-3181-2525
Iris A. Holmes https://orcid.org/0000-0001-6150-6150
Erin P. Westeen https://orcid.org/0000-0001-7685-4588
Maggie R. Grundler https://orcid.org/0000-0002-7104-0494
Peter A. Cerda https://orcid.org/0000-0001-5275-5841
Ivan V. Monagan, Jr. https://orcid.org/0000-0001-9506-8064
Gregory G. Pandelis https://orcid.org/0000-0001-8802-9470
Alison R. Davis Rabosky https://orcid.org/0000-0002-4664-8246

Data availability
All data that support the findings of this study are available in the main text or Supplementary Information:

Table S1. Additional morphomentrical and ecological data collected during the 2018 expedition of the UMMZ in Nicaragua. Occurrences, GenBank, UMMZ and field specimen codes, morphological data, and ecological observations.

The data underpinning the analysis reported in this paper are deposited in the Dryad Data Repository at https://doi.org/10.5061/dryad.18931zd46.

REFERENCES

Armstead J V (2017) Systematics and ecology of *Anolis biporcatus* (Squamata: Iguanidae). Salamandra 53: 285–293.

Barquero MD, Arguedas V (2019) Biology of snakes of the genus *Tretanorhinus*: an integrative review. Amphibian and Reptile Conservation 13: 227–238.

Barrio-Amorós CL (2019) On the Taxonomy of snakes in the genus *Leptodeira*, with an emphasis on Costa Rican species. IRCF Reptiles & Amphibians 26: 1–15.

Batista A, Ponce M, Vesely M, Mebert K, Hertz A, Köhler G, Carrizo A, Lotzkat S (2015) Revision of the genus *Lepidoblepharis* (Reptilia: Squamata: Sphaerodactylidae) in Central America, with the description of three new species. Zootaxa 3994: 187. https://doi.org/10.11646/zootaxa.3994.2.2

Brown TW, van den Burg MP, Maryon DF, Arrivillaga C (2018) Arboreality and diet in Pacific Long-tailed Snakes, *Enulius flavitorques* (Squamata: Dipsadidae), and a potential adaptive hypothesis for egg attendance in Honduran Leaftoed Geckos, *Phyllodactylus palmeus* (Squamata: Phyllodactylidae). IRCF Reptiles & Amphibians 25: 31–34.

Castoe TA, Sasa MM, Parkinson CL (2005) Modeling nucleotide evolution at the mesoscale: the phylogeny of the Neotropical pitvipers of the *Porthidium* group (Viperidae: Crotalinae). Molecular Phylogenetics and Evolution 37: 881–898. https://doi.org/10.1016/j.ympev.2005.05.013

Chavarría-Duriaux L, Hille DC, Dean R (2018) Birds of Nicaragua: a field guide. Zona Tropical Press, New York, USA, 480 pp.

Cisneros-Heredia DF, Mcdiarmid RW (2007) Revision of the characters of Centrolenidae (Amphibia: Anura: Athesphatanura), with comments on its taxonomy and the description of new taxa of glassfrogs. Zootaxa 1572: 1–82. https://doi.org/10.11646/zootaxa.1572.1.1

Cryer J, Wynne F, Price SJ, Puschendorf R (2019) Cryptic diversity in *Lithobates warszewitschii* (Amphibia, Anura, Ranidae). ZooKeys 838: 49–69. https://doi.org/10.3897/zookeys.838.29635

Davis Rabosky AR, Moore TY, Sánchez-Paredes CM, Westeen EP, Larson JG, Sealey BA, Balinskia BA (2019) Convergence and divergence in anti-predator displays: a novel approach to quantitative behavioural comparison in snakes. bioRxiv. https://doi.org/https://doi.org/10.1101/849703

Daza JM, Smith EN, Páez VP, Parkinson CL (2009) Complex evolution in the Neotropics: the origin and diversification

of the widespread genus *Leptodeira* (Serpentes: Colubridae). Molecular Phylogenetics and Evolution 53: 653–667. https://doi.org/10.1016/j.ympev.2009.07.022

Devitt TJ, LaDuc TJ, McGuire JA (2008) The *Trimorphodon biscutatus* (Squamata: Colubridae) species complex revisited: a multivariate statistical analysis of geographic variation. Copeia 2008: 370–387. https://doi.org/10.1643/ch-07-045

DuBay SG, Fuldner CC (2017) Bird specimens track 135 years of atmospheric black carbon and environmental policy. Proceedings of the National Academy of Sciences 114: 11321–11326. https://doi.org/10.1073/pnas.1710239114

Edgar RC (2004) MUSCLE: multiple sequence alignment with high accuracy and high throughput. Nucleic Acids Research 32: 1792–1797. https://doi.org/10.1093/nar/gkh340

Fernández M, Martínez-Fonseca JG, Salazar-Saavedra M, Gutiérrez L, Loza J, Sunyer J (2017) First verified record of *Cerrophidion wilsoni* (Reptilia: Squamata: Viperidae) from Nicaragua. Mesoamerican Herpetology 4: 481–484.

Fuentes Magallón R, Castillo M, Belton E, Zambrano E, Quintero-Arrieta H, Batista A (2021) Dead snake! A strategy for survival: thanatosis in some Panamanian snakes with a review of death-feigning in American snakes. Reptiles & Amphibians 28: 389–396. https://doi.org/10.17161/randa.v28i3.15753

García-Roa R, Sunyer J (2012) New distribution records of *Gymnophthalmus speciosus* (Hallowell, 1861) (Squamata, Gymnophthalmidae) in Nicaragua. Herpetology Notes 5: 539–542.

Golden AS, Naisilsisili W, Ligairi I, Drew JA (2014) Combining natural history collections with fisher knowledge for community-based conservation in Fiji. PLoS ONE 9: e98036. https://doi.org/10.1371/journal.pone.0098036

Grismer LL (2002) Amphibians and \reptiles of Baja California. University of California Press, Berkeley, USA, 413 pp.

Gutiérrez-García TA, Vázquez-Domínguez E (2013) Consensus between genes and stones in the biogeographic and evolutionary history of Central America. Quaternary Research 79: 311–324. https://doi.org/10.1016/j.yqres.2012.12.007

Hansen MC, Potapov P V., Moore R, Hancher M, Turubanova SA, Tyukavina A, Thau D, Stehman S V., Goetz SJ, Loveland TR, Kommareddy A, Egorov A, Chini L, Justice CO, Townshend JRG (2013) High-resolution global maps of 21st-century forest cover change. Science 342: 850–853. https://doi.org/10.1126/science.1244693

Hedges SB, Duellman WE, Heinicke MP (2008) New World direct-developing frogs (Anura: Terrarana): molecular phylogeny, classification, biogeography, and conservation. Zootaxa 1737: 1. https://doi.org/10.11646/zootaxa.1737.1.1

HerpetoNica (2015) Guia ilustrada de los anfibios y reptiles de Nicaragua (Herpetonicas). Ministerio de Ambiente y los Recursos Naturales (MARENA), Managua, Nicaragua, 521 pp.

Hillis DM, de Sá RO (1988) Phylogeny and taxonomy of the *Rana palmipes* Group (Salientia: Ranidae). Herpetological Monographs 2: 1–26. https://doi.org/10.2307/1467024

Holdridge LR (1967) Life zone ecology. Tropical Science Center, San José, Costa Rica, 206 pp.

Holmes MW, Hammond TT, Wogan GOU, Walsh RE, LaBarbera K, Wommack EA, Martins FM, Crawford JC, Mack KL, Bloch LM, Nachman MW (2016) Natural history collections as windows on evolutionary processes. Molecular Ecology 25: 864–881. https://doi.org/10.1111/mec.13529

Incer J (1973) Geografía ilustrada de Nicaragua. Recalde, Managua, Nicaragua, 280 pp.

Incer J (1975) Geografía básica de Nicaragua. Libreria y Editorial Recalde, Managua, Nicaragua, 134 pp.

Ingrasci MJ (2011) Molecular systematics of the coffee snakes, genus *Ninia* (Colubridae: Dipsadinae). University of Texas at Arlington, Arlington, USA, 127 pp.

Klank J, Chaves G, Arias E (2020) Range expansion of the Gulf Coast Toad, *Incilius valliceps* (Wiegmann, 1833) (Anura, Bufonidae), from Costa Rica. Check List 16: 753–757. https://doi.org/10.15560/16.3.753

Köhler G (2001) Anfibios y reptiles de Nicaragua. Herpeton, Offenbach, Germany, 208 pp.

Köhler G (2008) Reptiles of Central America, 2nd edition. Herpeton, Offenbach, Germany, 400 pp.

Köhler G (2011) Amphibians of Central America. Herpeton, Offenbach, Germany, 379 pp.

Köhler G, Kreutz J (1999) *Norops macrophallus* (WERNER, 1917), a valid species of anole from Guatemala and El Salvador. Herpetozoa 12: 57–65.

Köhler G, Schmidt F (2001) Zweiter Nachweis von *Nothopsis rugosus* Cope, 1871 aus Nicaragua. Salamandra 37: 61–64.

Köhler G, Sunyer J (2008) Two new species of anoles fomerly referred to as *Anolis limifrons* (Squamata: Polychrotidae). Herpetologica 64: 92–108. https://doi.org/10.1655/07-027.1

Köhler G, Vesely M (2010) A revision of the *Anolis sericeus* complex with the resurrection of *A. wellbornae* and the description of a new species (Squamata: Polychrotidae). Herpetologica 66: 207–228. https://doi.org/10.1655/07-074r1.1

Köhler G, Schulze A, Vesely M (2005) Morphological variation in *Norops capito* (PETERS, 1863), a wide-spread species in southeastern Mexico and Central America. Salamandra 41: 129–136.

Köhler G, Townsend JH, Petersen CBP (2016) A taxonomic revision of the *Norops tropidonotus* complex (Squamata, Dactyloidae), with the resurrection of *N. spilorhipis* (Álvarez del Toro and Smith, 1956) and the description of two new species. Mesoamerican Herpetology 3: 8–41.

Köhler G, McCranie JR, Nicholson KE, Kreutz J (2003) Geographical variation in hemipenal morphology in *Norops humilis* (Peters 1863), and the systematic status of *Norops quaggulus* (Cope 1885) (Reptilia, Squamata, Polychrotidae). Senckenbergiana Biologica 82: 213–222.

Köhler G, Alt S, Grünfelder C, Dehling M, Sunyer J (2006) Morphological variation in Central American leaf-litter anoles (*Norops humilis*, *N. quaggulus*, and *N. uniformis*). Salamandra 42: 239–254.

Köhler G, Salazar Saavedra M, Martinez J, Lopez G, Sunyer J (2013) First record of *Aspidoscelis motaguae* (Sackett, 1941) (Reptilia: Squamata: Teiidae) from Nicaragua. Check List 9: 475. https://doi.org/10.15560/9.2.475

Kronauer DJC, Bergmann PJ, Mercer JM, Russell AP (2005) A phylogeographically distinct and deep divergence in the widespread Neotropical Turnip-tailed Gecko, *Thecadactylus rapicauda*. Molecular Phylogenetics and Evolution

34: 431–437. https://doi.org/10.1016/j.ympev.2004.10.009

Linn AJ, Reuther JD, Wooley CB, Shirar SJ, Rogers JS (2017) Museum cultural collections: pathways to the preservation of traditional and scientific knowledge. Arctic Science 3: 618–634. https://doi.org/10.1139/as-2017-0001

Loza J, Sunyer J, Reid FA, Martínez-Fonseca JG (2018) First capture of *Diclidurus albus* Wied-Neuwied, 1820 (Mammalia, chiroptera, emballonuridae) from Nicaragua. Check List 14: 1021–1025. https://doi.org/10.15560/14.6.1021

Loza JC, Gutiérrez L, Salazar-saavedra M, Martínez-Fonseca JG, Fernández M, Sunyer J (2017) First record of *Rhadinella godmani* (Reptilia: Squamata: Dipsadidae) from Nicaragua. Mesoamerican Herpetology 4: 476–478.

Luque-Montes I, Austin JD, Weinfurther KD, Wilson LD, Hofmann EP, Townsend JH (2018) An integrative assessment of the taxonomic status of putative hybrid leopard frogs (Anura: Ranidae) from the Chortís Highlands of Central America, with description of a new species. Systematics and Biodiversity 16: 340–356. https://doi.org/10.1080/14772000.2017.1415232

MARENA (Ministerio de Ambiente y los Recursos Naturales) (1999) Biodiversidad en Nicaragua, un Estudio de País. Ministerio del Ambiente y los Recursos Naturales, Managua, Nicaragua, 271pp.

Marshall JS (2007) The geomorphology and physiographic provinces of Central America. In: Bundschuh, Alvarado (Eds.) Central America: geology, resources and hazards. CRC Press, Boca Raton, USA, 51pp.

Martínez-Fonseca JG, Gutiérrez-Lopez LE, Sunyer J (2015) Distribution notes: *Incilius valliceps* (Wiegmann, 1833). Mesoamerican Herpetology 2: 537.

Martínez-Fonseca JG, Yasuda K, Sunyer J (2016) Distribution notes: *Bothrops asper* (Garman, 1884). Mesoamerican Herpetology 3: 777. https://doi.org/10.2108/zsj.28.743

Martínez-Fonseca JG, Medina-Fitoria A, Westeen EP, Chambers CL (2020) Revised checklist of the bats (Mammalia: Chiroptera) of Nicaragua. Occasional Papers of the Museum of Texas Tech University 369: 36.

Martínez-Fonseca JG, Reid FA, Loza J, Gutiérrez-López L, Sunyer J (2018) New records of *Diplomys labilis* (Bangs, 1901) (Mammalia, Rodentia, Echimyidae) from Nicaragua. Check List 14: 555–558. https://doi.org/10.15560/14.3.555

Martínez-Fonseca JG, Loza J, Fernandez M, Salazar-Saavedra M, Sunyer J (2019a) First country record of *Rhinobothryum bovallii* (Andersson, 1916) (Squamata, Colubridae) from Nicaragua. Check List 15: 555–563. https://doi.org/10.15560/15.4.555

Martínez-Fonseca JG, Sunyer J, Salazar-Saavedra M, Gutiérrez-López LE, Van den Berghe E (2019b) The amphibians and reptiles of the department of Carazo, Central-Pacific Nicaragua. Revista Nicaraguense de Biodiversidad 44: 1–53.

May R von, Catenazzi A, Santa-Cruz R, Gutierrez AS, Moritz C, Rabosky DL (2019) Thermal physiological traits in tropical lowland amphibians: vulnerability to climate warming and cooling. PLoS ONE 14: e0219759. https://doi.org/10.1371/journal.pone.0219759

McCranie JR (2004) *Enuliophis*, *E. sclateri*. Catalogue of American amphibians and reptiles 799: 1–2.

McCranie JR (2011) The snakes of Honduras. Society for the Study of Amphibians and Reptiles, Ithaca, USA, 724 pp.

McCranie JR (2017) Morphological and systematic comments on the Caribbean lowland population of *Smilisca baudinii* (Anura: Hylidae: Hylinae) in northeastern Honduras, with the resurrection of *Hyla manisorum* Taylor. Mesoamerican Herpetology 4: 15.

McCranie JR (2018) The lizards, crocodiles, and turtles of Honduras. Systematics, distribution, and conservation. Bulletin of the Museum of Comparative Zoology 15: 1–129. https://doi.org/10.3099/0027-4100-15.1.1

McCranie JR, Wilson LD (1993) Taxonomic changes associated with the names *Hyla spinipollex* Schmidt and *Ptychohyla merazi* Wilson and McCranie (Anura: Hylidae). The Southwestern Naturalist 38: 100. https://doi.org/10.2307/3672060

McCranie JR, Wilson LD (2003) *Eleutherodactylus operosus* Savage, McCranie, and Wilson, 1999: a synonym of *Eleutherodactylus cerasinus* (Cope, "1876" [1875]). Journal of Herpetology 37: 408–409. https://doi.org/10.1670/0022-1511(2003)037[0408:eosmaw]2.0.co;2

McCranie JR, Hedges SB (2012) Two new species of geckos from Honduras and resurrection of *Sphaerodactylus continentalis* Werner from the synonymy of *Sphaerodactylus millepunctatus* Hallowell (Reptilia, Squamata, Gekkonoidea, Sphaerodactylidae). Zootaxa 3492: 65–76. https://doi.org/https://doi.org/10.11646/zootaxa.3492.1.4

McCranie JR, Köhler G (2015) The anoles (Reptilia: Squamata: Dactyloidae: *Anolis*: *Norops*) of Honduras. Systematics, distribution, and conservation. Bulletin of the Museum of Comparative Zoology 161: 1–280. https://doi.org/10.3099/0027-4100-14.1.1

McCranie JR, Sunyer J, Martínez-Fonseca JG (2019) Comments and updates to "Guía Ilustrada de Anfibios y Reptiles de Nicaragua" along with taxonomic and related suggestions associated with the herpetofauna of Nicaragua. Revista Nicaragüense de Biodiversidad 52: 1–44.

Medina-Fitoria A, Saldaña O, MacCarthy T, Vílchez S (2010) Nuevos reportes y comentarios históricos de murciélagos (Orden Chiroptera) para la fauna de Nicaragua. Biodiversidad Revista Nicaragüense: 93–102.

Montingelli GG, Grazziotin FG, Battilana J, Murphy RW, Zhang Y, Zaher H (2019) Higher-level phylogenetic affinities of the Neotropical genus *Mastigodryas* Amaral, 1934 (Serpentes: Colubridae), species-group definition and description of a new genus for *Mastigodryas bifossatus*. Journal of Zoological Systematics and Evolutionary Research 57: 205–239. https://doi.org/10.1111/jzs.12262

Múnera-Roldán C, Cody ML, Schiele-Zavala RH, Sigel BJ, Woltmann S, Kjeldsen JP (2007) New and noteworthy records of birds from south-eastern Nicaragua. Bulletin of British Ornitologists' Club 127: 152–160.

Muñoz MM, Crandell KE, Campbell-Staton SC, Fenstermacher K, Frank HK, Van Middlesworth P, Sasa M, Losos JB, Herrel A (2015) Multiple paths to aquatic specialisation in four species of Central American *Anolis* lizards. Journal of Natural History 49: 1717–1730. https://doi.org/10.1080/00222933.2015.1005714

Nascimento LB, Caramaschi U, Cruz CAG (2005) Taxonomic review of the species groups of the genus *Physalaemus*

Fitzinger, 1826 with revalidation of the genera *Engystomops* Jiménez-de-la-Espada, 1872 and *Eupemphix* Steindachner, 1863 (Amphibia, Anura, Leptodactylidae). Arquivos do Museu Nacional, Rio de Janeiro 63: 297–320.

Phillips JG, Deitloff J, Guyer C, Huetteman S, Nicholson KE (2015) Biogeography and evolution of a widespread Central American lizard species complex: *Norops humilis*, (Squamata: Dactyloidae). BMC Evolutionary Biology 15: 143. https://doi.org/10.1186/s12862-015-0391-4

Portillo-Quintero CA, Sánchez-Azofeifa GA (2010) Extent and conservation of tropical dry forests in the Americas. Biological Conservation 143: 144–155. https://doi.org/10.1016/j.biocon.2009.09.020

Pröhl H, Ron SR, Ryan MJ (2010) Ecological and genetic divergence between two lineages of Middle American túngara frogs *Physalaemus* (= *Engystomops*) *pustulosus*. BMC Evolutionary Biology 10: 1–18. https://doi.org/10.1186/1471-2148-10-146

Ramírez-Castañeda V, Westeen EP, Frederick J, Amini S, Wait DR, Achmadi AS, Andayani N, Arida E, Arifin U, Bernal MA, Bonaccorso E, Sanguila MB, Brown RM, Che J, Condori FP, Hartiningtias D, Hiller AE, Iskandar DT, Jiménez RA, Khelifa R, Márquez R, Martínez-Fonseca JG, Parra JL, Peñalba JV, Pinto-García L, Razafindratsima OH, Ron SR, Souza S, Supriatna J, Bowie RCK, Cicero C, McGuire JA, Tarvin RD (2022) A set of principles and practical suggestions for equitable fieldwork in biology. Proceedings of the National Academy of Sciences of the United States of America 119: 1–9. https://doi.org/10.1073/pnas.2122667119

Reid FA (2009) A field guide to the mammals of southeast Mexico and Central America. Second edition. Oxford University Press, New York, USA, 346 pp.

Rödder D, Solé M, Böhme W (2008) Predicting the potential distributions of two alien invasive Housegeckos (Gekkonidae: *Hemidactylus frenatus*, *Hemidactylus mabouia*). North-Western Journal of Zoology 4: 236–246.

Ron SR, Mueses-Cisneros JJ, Gutiérrez-Cárdenas PDA, Rojas-Rivera A, Lynch RL, Rocha CFD, Galarza G (2015) Systematics of the endangered toad genus *Andinophryne* (Anura: Bufonidae): phylogenetic position and synonymy under the genus *Rhaebo*. Zootaxa 3947: 347. https://doi.org/10.11646/zootaxa.3947.3.3

Russell AP, Bauer AM (2002) *Thecadactylus, T. rapicauda*. Catalogue of American amphibians and reptiles 753: 1-16. Sá RO, Grant T, Camargo A, Heyer WR, Ponssa ML, Stanley E (2014) Systematics of the Neotropical genus *Leptodactylus* Fitzinger, 1826 (Anura: Leptodactylidae): phylogeny, the relevance of non-molecular evidence, and species accounts. South American Journal of Herpetology 9: S1–S100. https://doi.org/10.2994/sajh-d-13-00022.1

Salazar-Saavedra M, Loza J, Dávila P, Ruíz Pérez GA, Sunyer J (2018) First country records of the Guatemala Neckband Snake *Scaphiodontophis annulatus* (Duméril, Bibron and Duméril, 1854) (Squamata, Sibynophiidae) from Nicaragua. Revista Nicaraguense de Biodiversidad 39: 1–15.

Salazar-Saavedra M, Loza JC, Fernandez M, Martínez-Fonseca JG, Dwyer Q, Sunyer J (2015) *Chelonoidis carbonarius* (Spix , 1824): a member of the Nicaraguan herpetofauna. Mesoamerican Herpetology 2: 571–573.

Saldarriaga-Córdoba M, Parkinson CL, Daza JM, Wüster W, Sasa M (2017) Phylogeography of the Central American lancehead Bothrops asper (Serpentes: Viperidae). PLoS ONE 12: e0187969. https://doi.org/10.1371/journal.pone.0187969

Savage JM (2002) The amphibians and reptiles of Costa Rica: a herpetofauna between two continents, between two seas. University of Chicago Press, Chicago, USA and London, UK, 954 pp.

Savage JM, Slowinski JB (1996) Evolution of coloration, urotomy and coral snake mimicry in the snake genus *Scaphiodontophis* (Serpentes: Colubridae). Biological Journal of the Linnean Society 57: 129–194. https://doi.org/10.1111/j.1095-8312.1996.tb01833.x

Smith EN, Ferrari-Castro JA (2008) A new species of jumping pitviper of the genus *Atropoides* (Serpentes: Viperidae: Crotalinae) from the Sierra de Botaderos and the Sierra La Muralla, Honduras. Zootaxa 1948: 57–68. https://doi.org/10.11646/zootaxa.1948.1.3

Solis-Zurita C, De Luna E, González D (2019) Phylogenetic relationships in the *Sceloporus variabilis* (Squamata: Phrynosomatidae) complex based on three molecular markers, continuous characters and geometric morphometric data. Zoologica Scripta 48: 419–439. https://doi.org/10.1111/zsc.12349

Stamatakis A (2014) RAxML version 8: a tool for phylogenetic analysis and post-analysis of large phylogenies. Bioinformatics 30: 1312–1313. https://doi.org/10.1093/bioinformatics/btu033

Stevens WD, Ulloa CU, Pool A, Montiel OM (2001) Flora de Nicaragua. Tomo II. Monographs in Systematic Botany from the Missouri Botanical Garden. Missouri Botantical Garden, St. Louis USA, 966 pp.

Sunyer J (2009) Taxonomy, zoogeography, and conservation of the herpetofauna of Nicaragua. Doctoral thesis, Goethe-Universität, Frankfurt, Germany, 281 pp.

Sunyer J (2014) An updated checklist of the amphibians and reptiles of Nicaragua. Mesoamerican Herpetology 1: 186–202.

Sunyer J, Fonseca JGM, Fernández MA, Olivas MFU, Obando LA (2014a) Noteworthy snake records from Nicaragua (Reptilia: Serpentes). Check List 10: 1134–1147. https://doi.org/10.15560/10.5.1134

Sunyer J, Jirón C, Acosta Antón AA, Gutiérrez Rodríguez AA (2017) Distribution notes: *Cerrophidion wilsoni* Jadin, Townsend, Castoe, and Campbell, 2012. Mesoamerican Herpetology 4: 967–969.

Sunyer J, Köhler G (2010) Conservation status of the herpetofauna of Nicaragua. In: Wilson LD, Townsend JH, Johnson JD (Eds.) Conservation of Mesoamerican amphibians and reptiles. Eagle Mountain Publishing, Eagle Mountain, USA, 488–509.

Sunyer J, Lotzkat S, Hertz A, Wake DB, Alemán B, Robleto S, Köhler G (2008) Two new species of salamanders (genus *Bolitoglossa*) from southern Nicaragua (Amphibia, Caudata, Plethodontidae). Senckenbergiana Biologica 88: 319–328.

Sunyer J, Martínez-Fonseca JG, Salazar-Saavedra M (2016) New departmental records for lizards in Nicaragua. Mesoamerican Herpetology 3: 1049–1054. https://doi.org/10.1016/j.ympev.2016.09.001.r

Sunyer J, Martínez-Fonseca JG, Salazar-Saavedra M, Galindo-Uribe DM, Obando LA (2014b) Range extensions and new departmental records for amphibians in Nicaragua. Mesoamerican Herpetology 1: 164–175.

Sunyer J, Páiz G, Dehling DM, Köhler G (2009) A collection of amphibians from Río San Juan, southeastern Nicaragua. Herpetology Notes 2: 189–202.

Sunyer J, Pierson T (2015) A float through history on Nicaragua's Río San Juan. Herp Nation Magazine 17: 46–55.

Townsend JH, McCranie JR, Wilson LD (2004) *Corytophanes cristatus* (Merrem). Catalogue of American Amphibians and Reptiles 789: 1–6.

Vences M, Nagy ZT, Sonet G, Verheyen E (2012) DNA barcoding amphibians and reptiles. In: Kress W, Erickson D (Eds.) Methods in Molecular Biology, vol. 858. Humana Press, Totowa, USA, 79–107. https://doi.org/10.1007/978-1-61779-591-6_5

Vinson GL, Brineman JH (1963) Nuclear Central America, hub of Antillean transverse belt. In: Childs OE, Beebe BW (Eds.) Backbone of the Americas: tectonic history from pole to pole. Memoirs of the American Association of Petroleum Geologists, Tulsa, USA, 101–112.

Wake MH (1988) *Gymnopis, G. multiplicata*. Catalogue of American Amphibians and Reptiles 411: 1–2.

Wallach V, Williams KL, Boundy J (2014) Snakes of the world: a catalogue of living and extinct species. CRC Press, Boca Raton, USA, 1209 pp. https://doi.org/10.1201/b16901

Wang IJ, Crawford AJ, Bermingham E (2008) Phylogeography of the Pygmy Rain Frog (*Pristimantis ridens*) across the lowland wet forests of isthmian Central America. Molecular Phylogenetics and Evolution 47: 992–1004. https://doi.org/10.1016/j.ympev.2008.02.021

Weeks BC, Willard DE, Zimova M, Ellis AA, Witynski ML, Hennen M, Winger BM (2020) Shared morphological consequences of global warming in North American migratory birds. Ecology Letters 23: 316–325. https://doi.org/10.1111/ele.13434

Wüster W, Yrausquin JL, Mijares-Urrutia A (2001) A new species of indigo snake from north-western Venezuela (Serpentes: Colubridae: *Drymarchon*). Herpetological Journal 11: 157–165.

APPENDIX

Maps showing specimens collected during the 2018 University of Michigan Museum of Zoology expedition in Nicaragua. Country codes: GUA = Guatemala; SLV = El Salvador; HON = Honduras; NIC = Nicaragua; CRI = Costa Rica. Records from the Global Biodiversity Information Facility and species range polygons from the International Union for Conservation of Nature are presented as reference. When available, we provide a tree of the 16S rRNA gene barcode illustrating its relationship with reference materials from GenBank. Reference materials are coded in color by their country of origin, with our samples displayed with their collection locality and museum accession number.

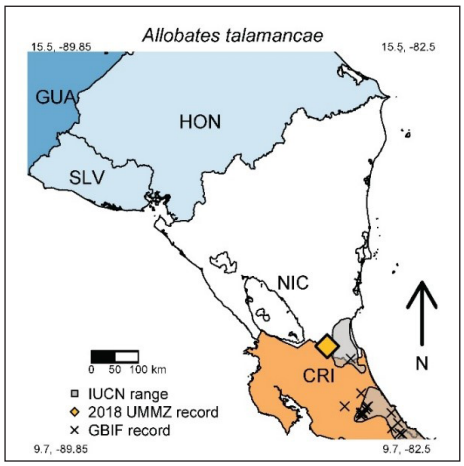

Figure A1. *Allobates talamancae.*

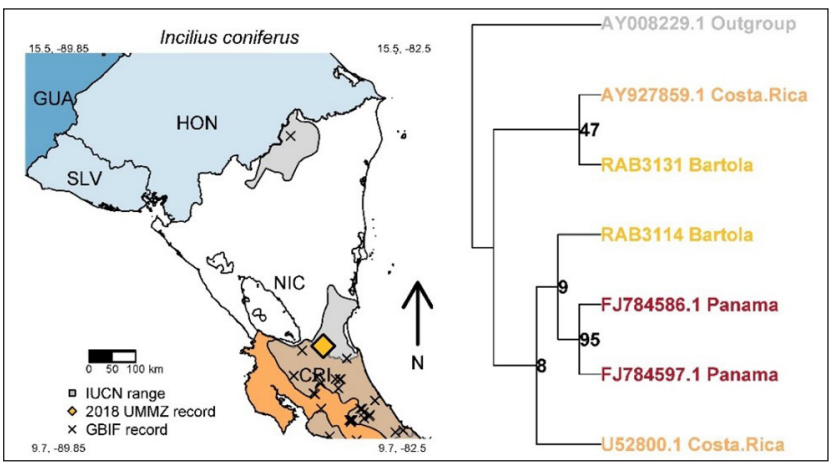

Figure A2. *Incilius coniferus.*

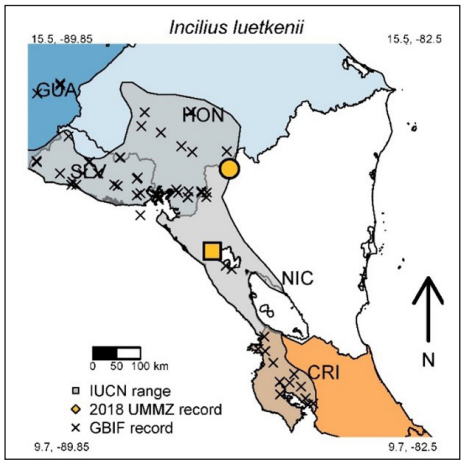

Figure A3. *Incilius luetkenii.*

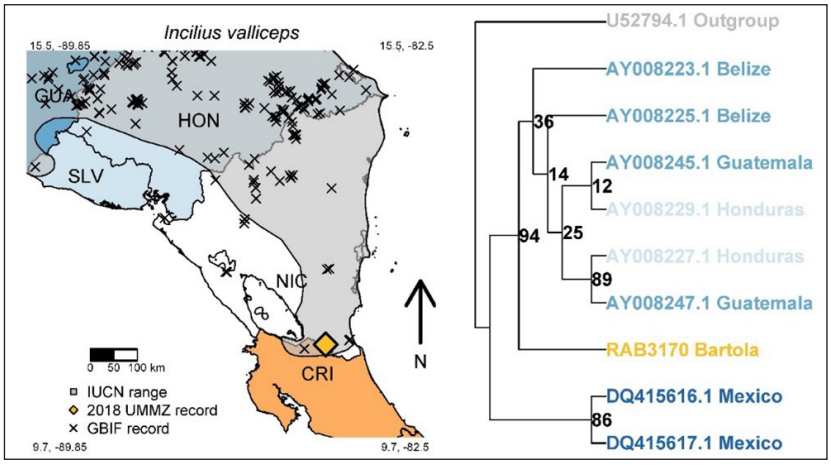

Figure A4. *Incilius valliceps.*

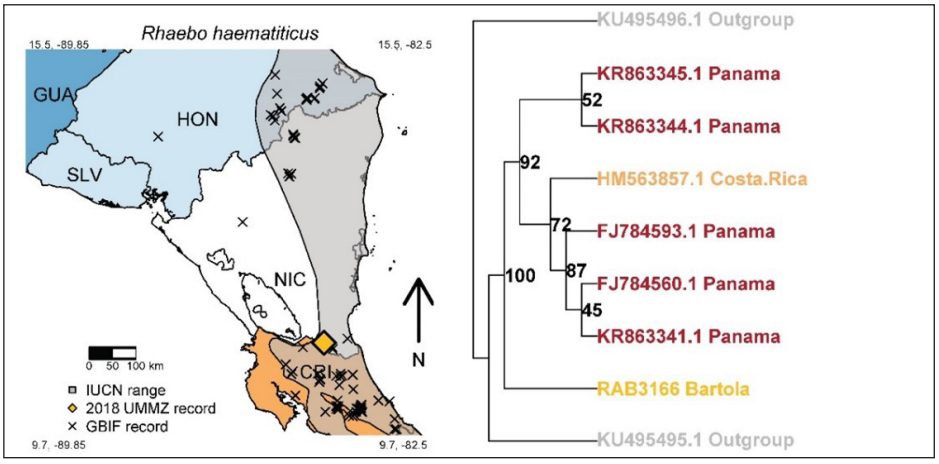

Figure A5. *Rhaebo haematiticus.*

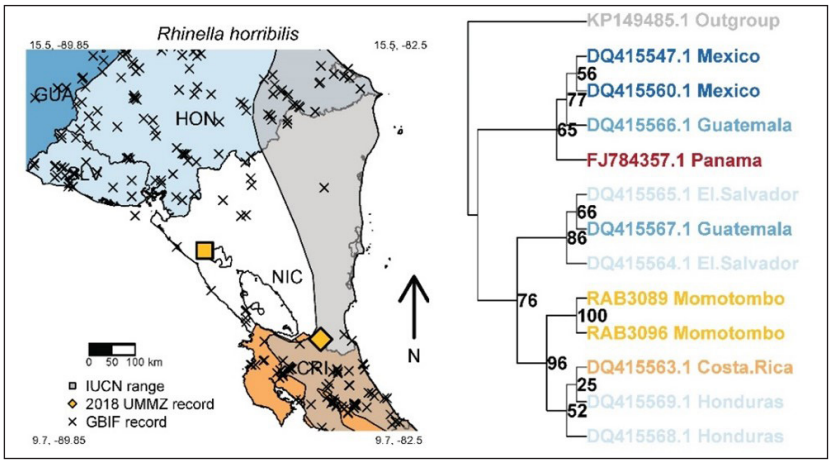

Figure A6. *Rhinella horribilis.*

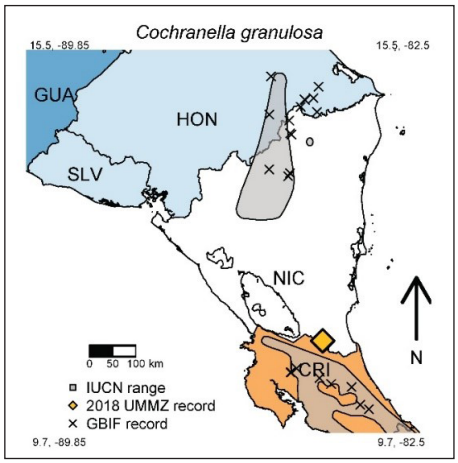

Figure A7. *Cochranella granulosa.*

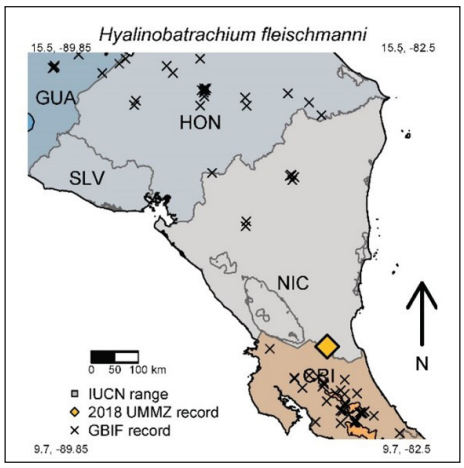

Figure A8. *Hylanobatrachium fleischmanni.*

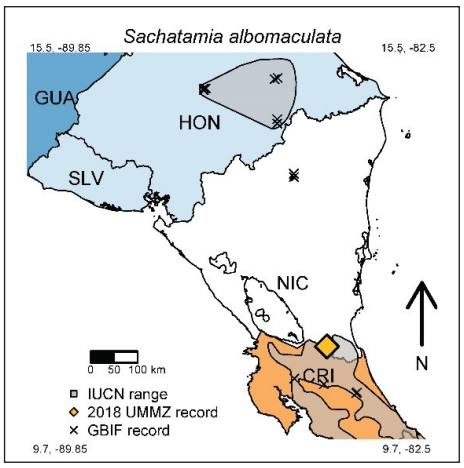

Figure A9. *Sachatamia albomaculata.*

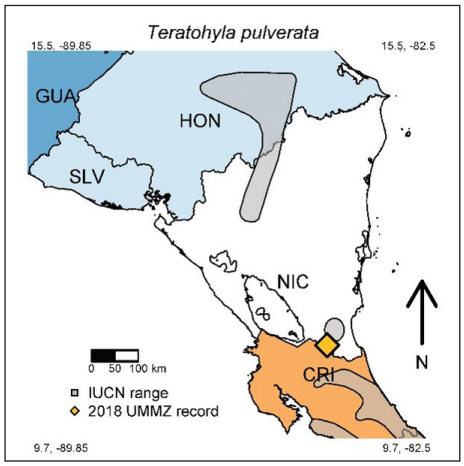

Figure A10. *Teratohyla pulverata.*

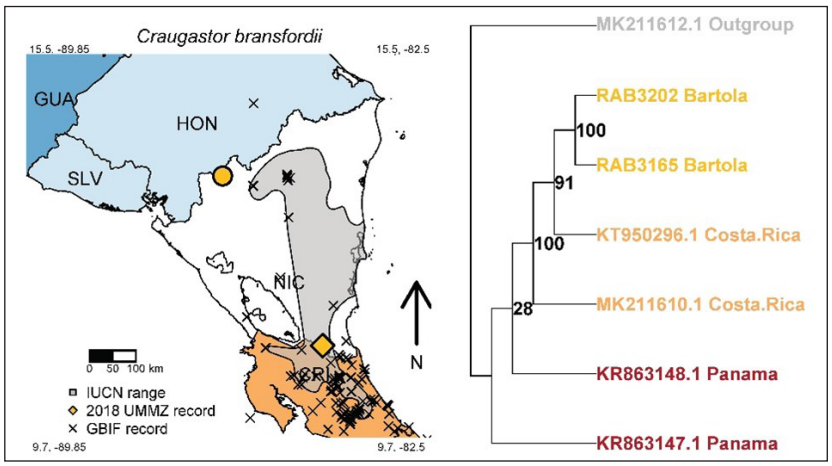

Figure A11. *Craugastor bransfordii.*

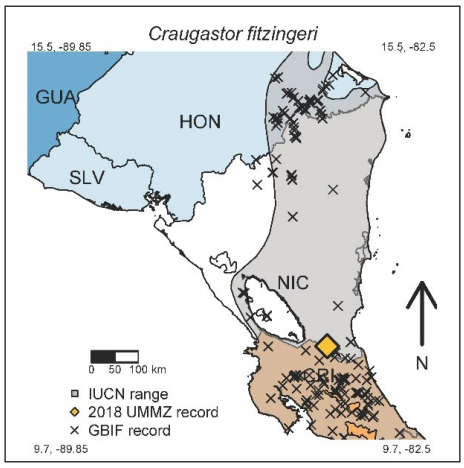

Figure A12. *Craugastor fitzingeri.*

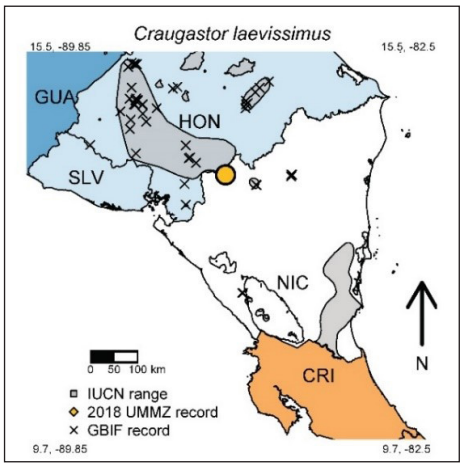

Figure A13. *Craugastor laevissimus.*

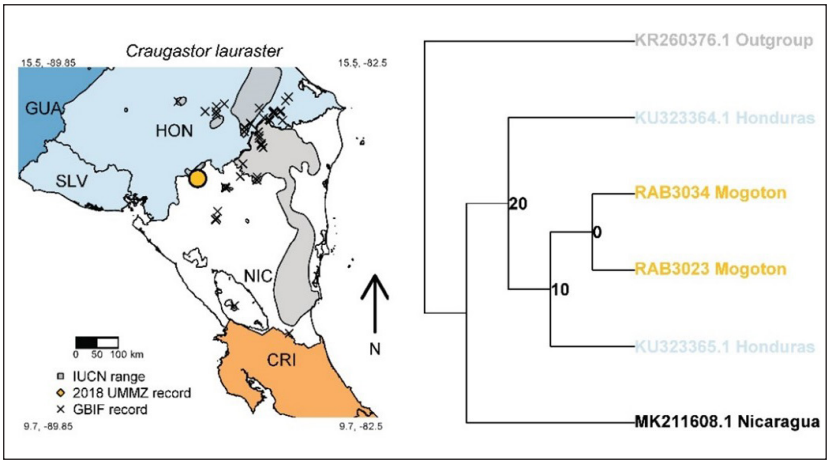

Figure A14. *Craugastor lauraster.*

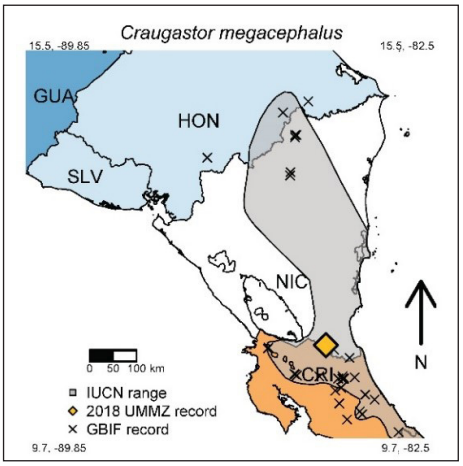

Figure A15. *Craugastor megacephalus.*

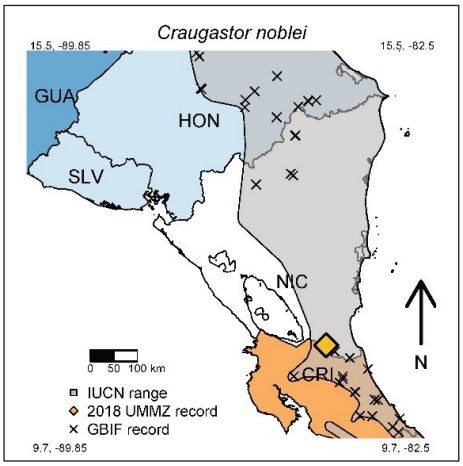

Figure A16. *Craugastor noblei.*

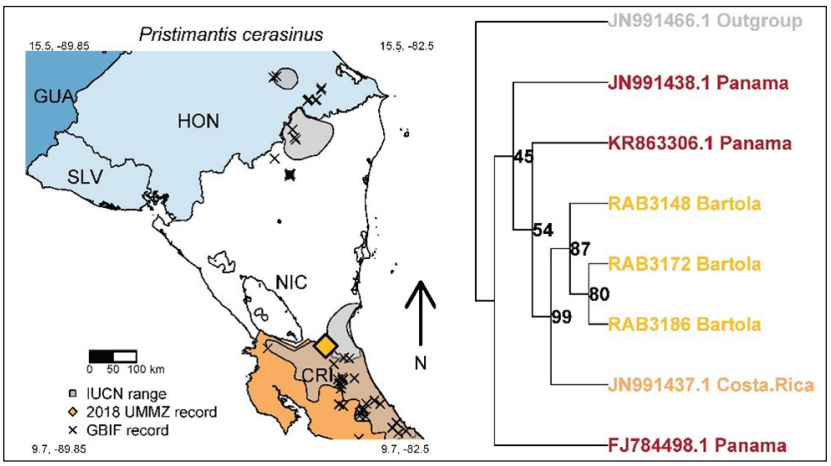

Figure A17. *Pristimantis cerasinus.*

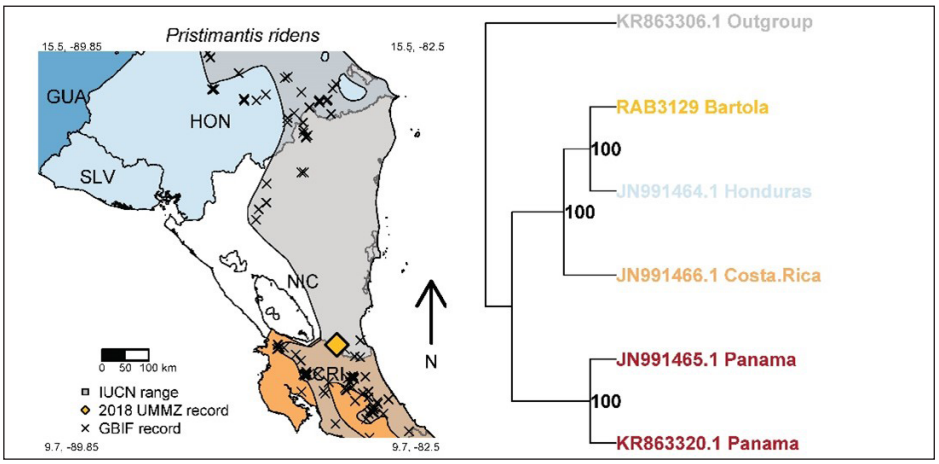

Figure A18. *Pristimantis ridens.*

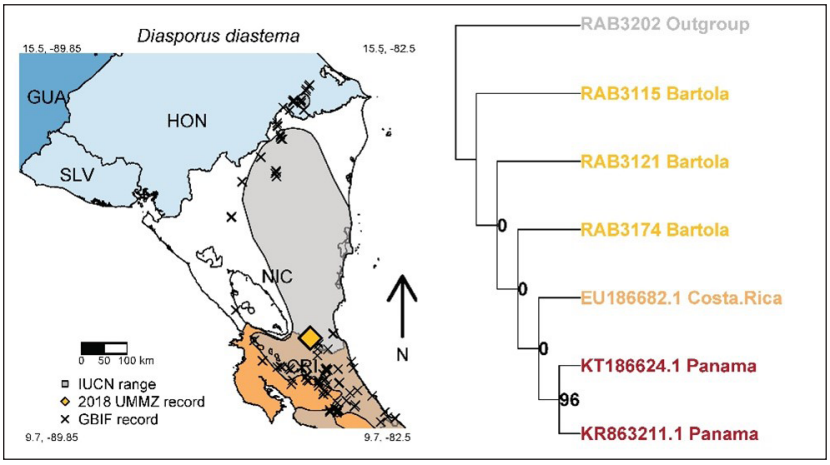

Figure A19. *Diasporus diastema.*

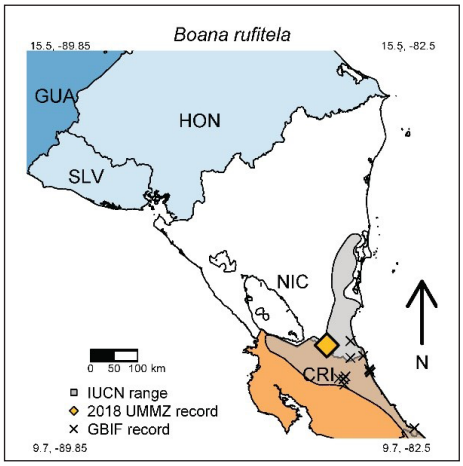

Figure A20. *Boana rufitela.*

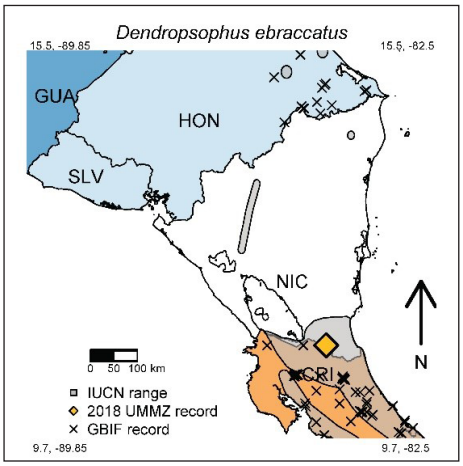

Figure A21. *Dendropsophus ebraccatus.*

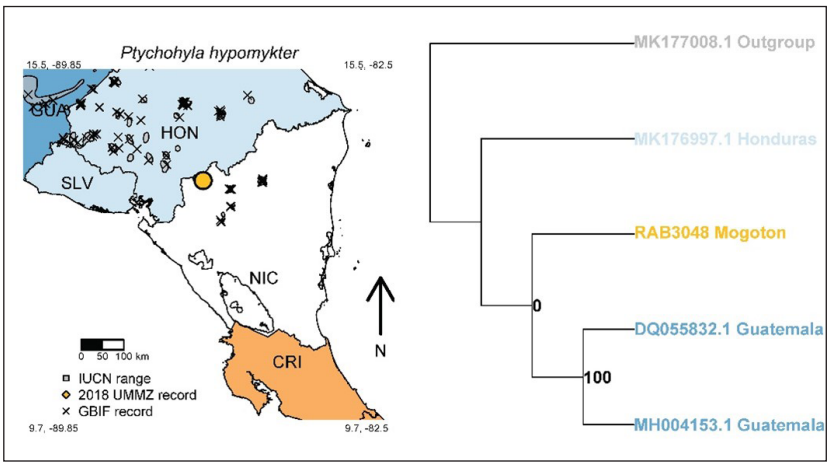

Figure A22. *Ptychohyla hypomykter.*

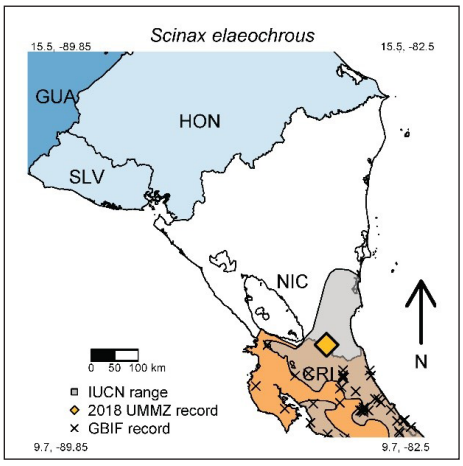

Figure A23. *Scinax elaeochroa.*

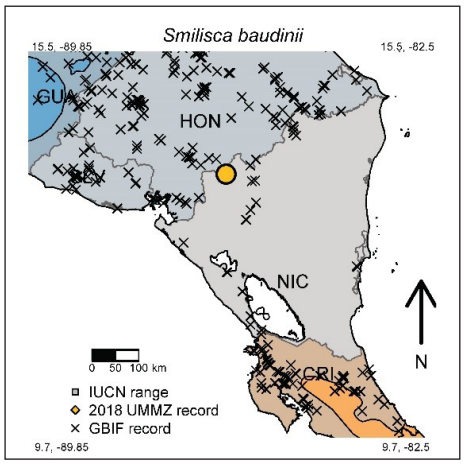

Figure A24. *Smilisca baudinii.*

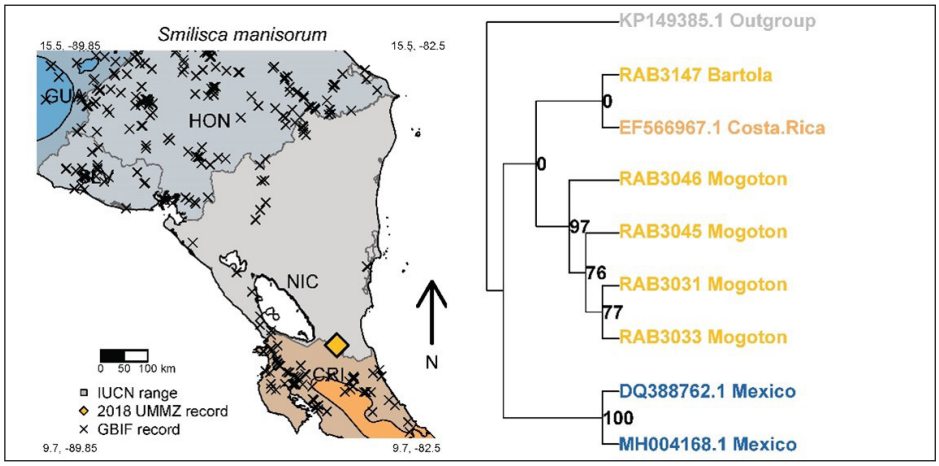

Figure A25. *Smilisca manisorum.*

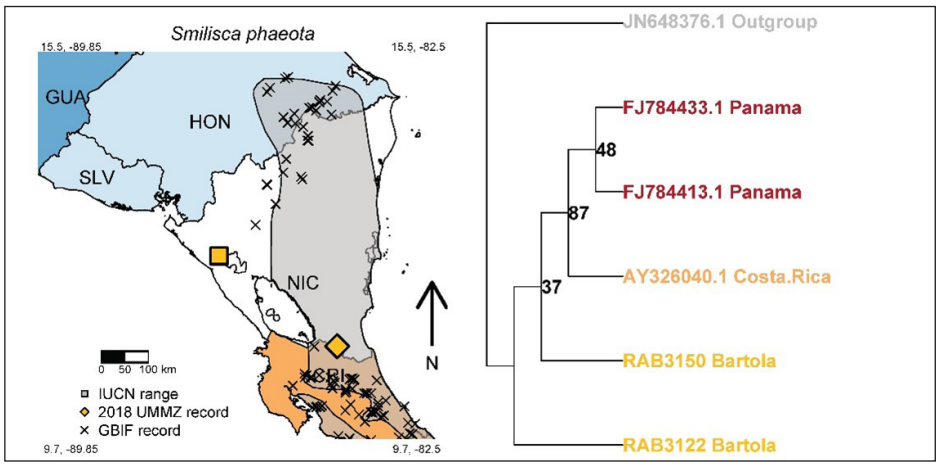

Figure A26. *Smilisca phaeota.*

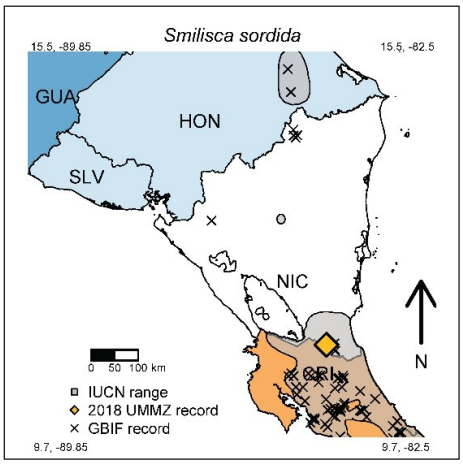

Figure A27. *Smilisca sordida.*

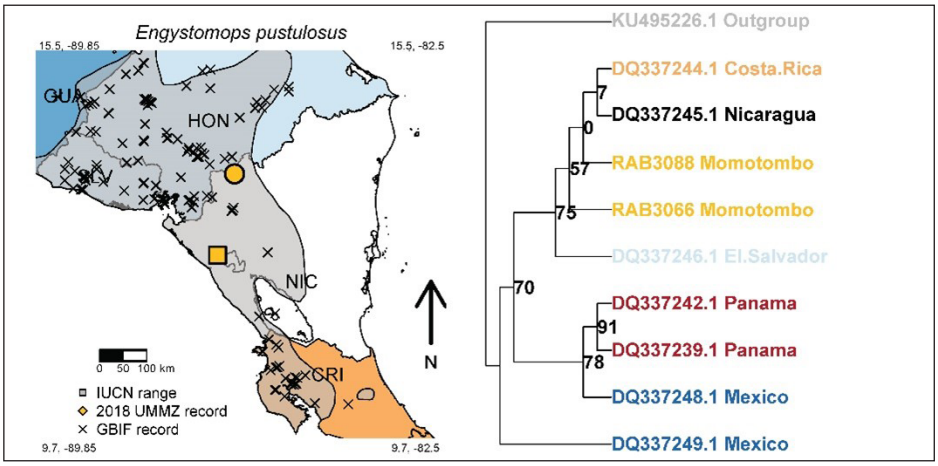

Figure A28. *Engystomops pustulosus.*

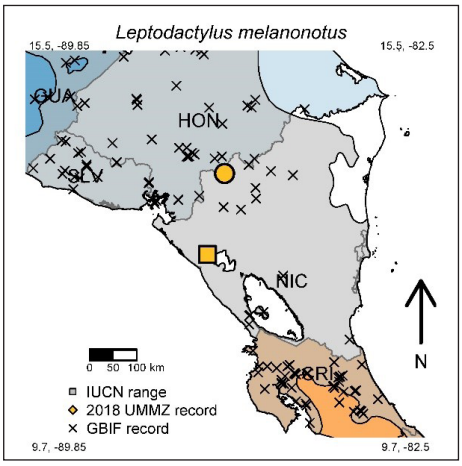

Figure A29. *Leptodactylus melanonotus.*

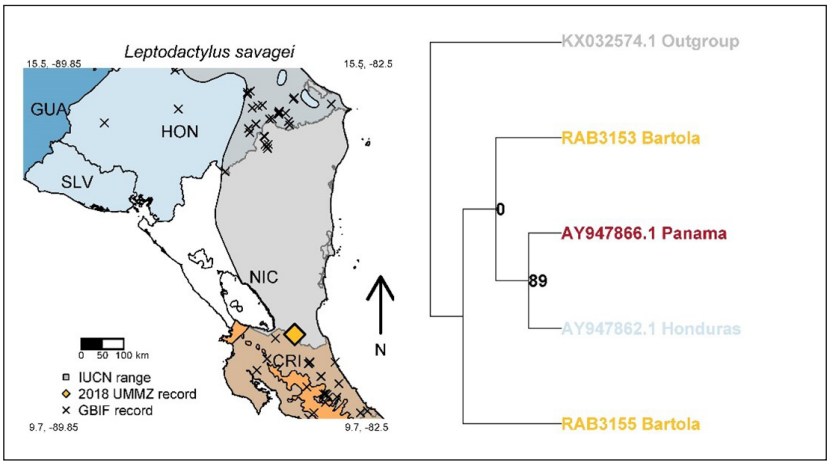

Figure A30. *Leptodactylus savage.*

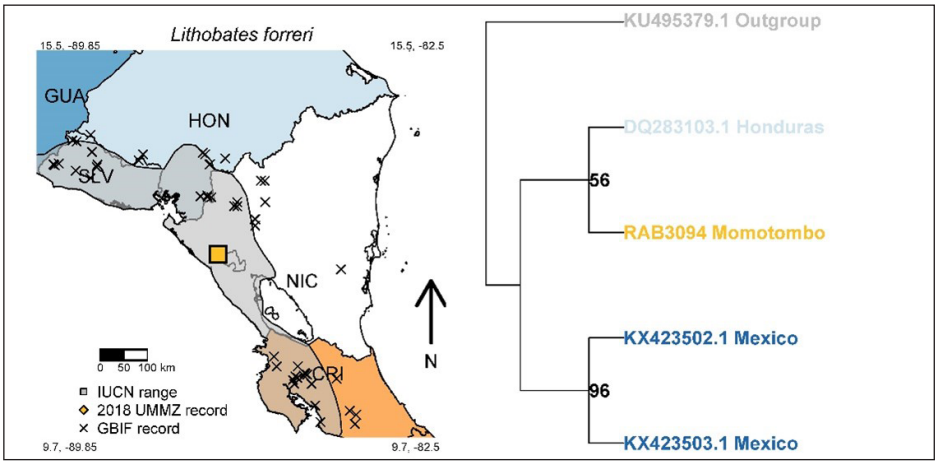

Figure A31. *Lithobates forreri.*

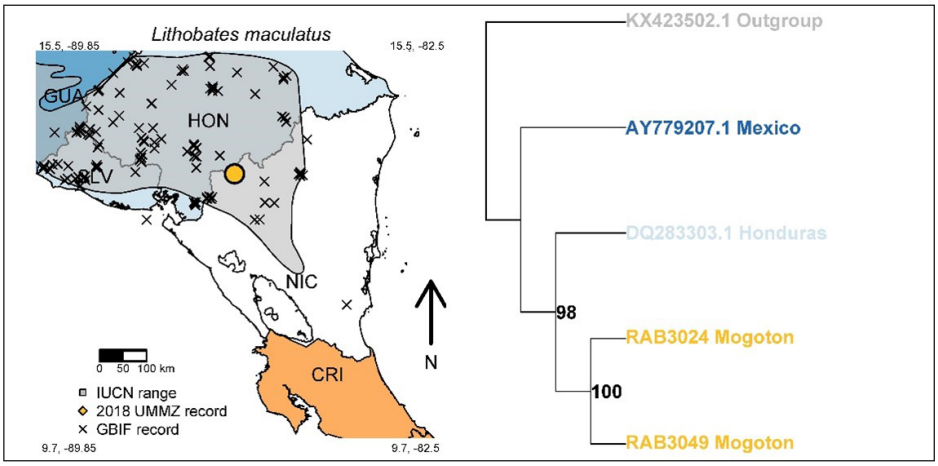

Figure A32. *Lithobates maculatus.*

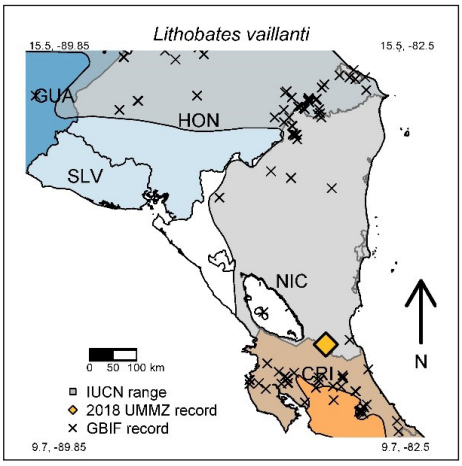

Figure A33. *Lithobates vaillanti.*

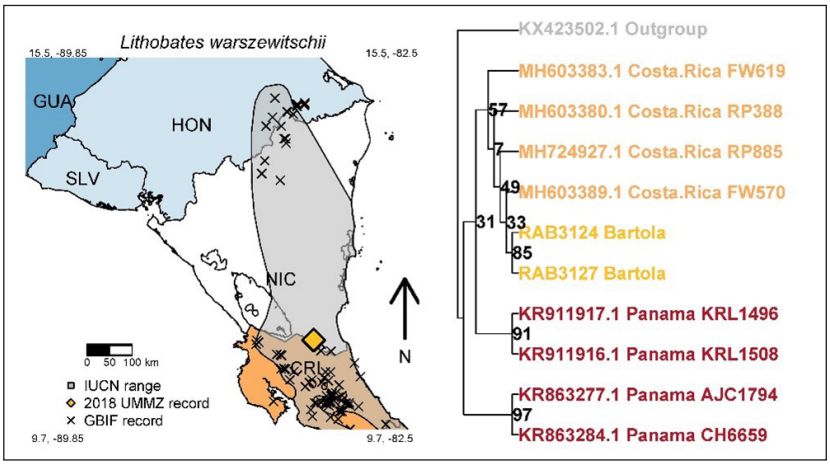

Figure A34. *Lithobates warszewitschii.*

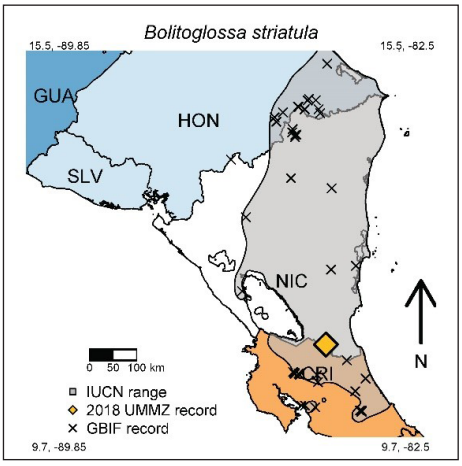

Figure A35. *Bolitoglossa striatula.*

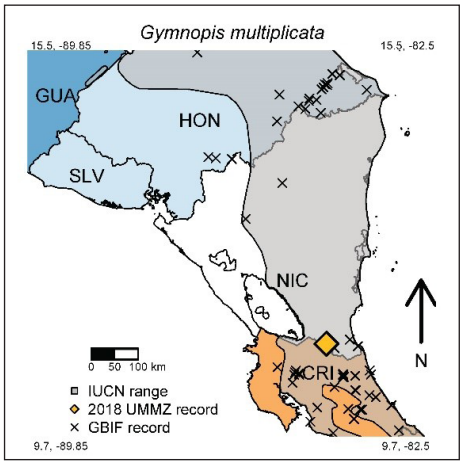

Figure A36. *Gymnophis multiplicata.*

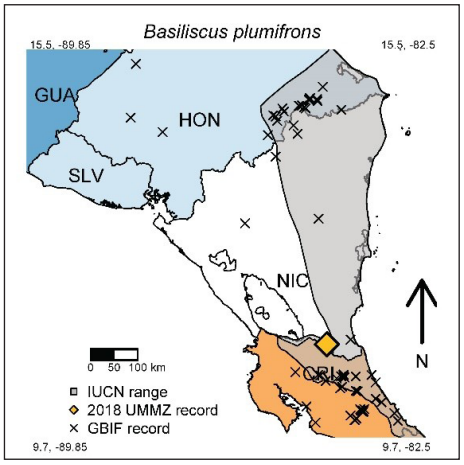

Figure A37. *Basiliscus plumifrons.*

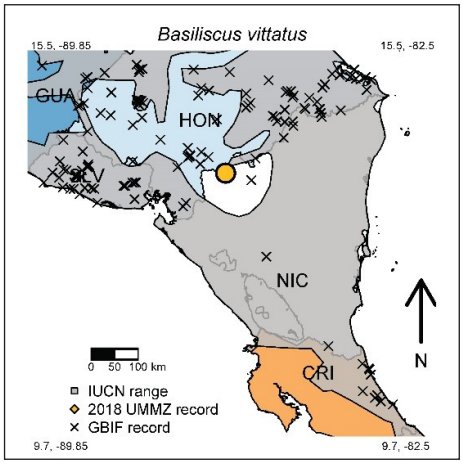

Figure A38. *Basiliscus vittatus.*

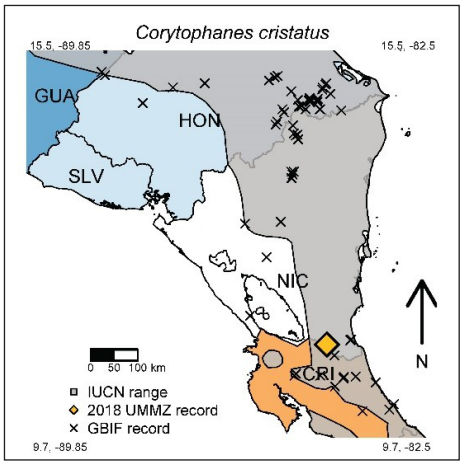

Figure A39. *Corytophanes cristatus.*

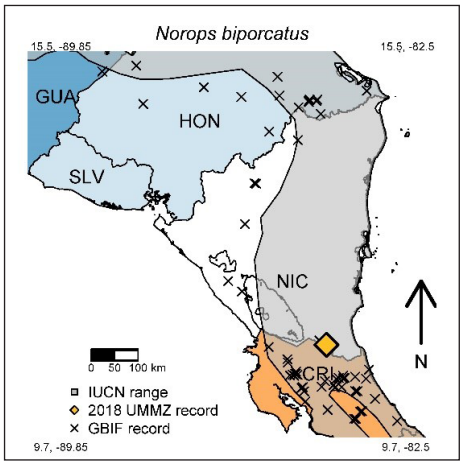

Figure A40. *Norops biporcatus.*

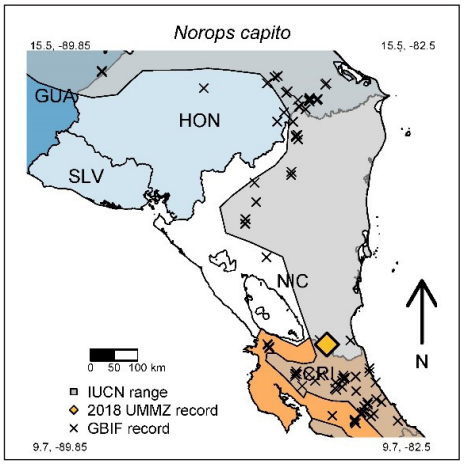

Figure A41. *Norops capito.*

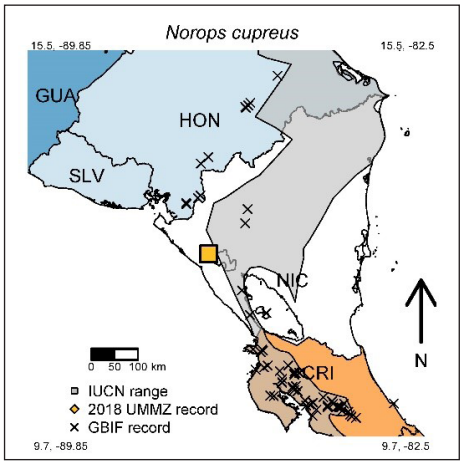

Figure A42. *Norops cupreus.*

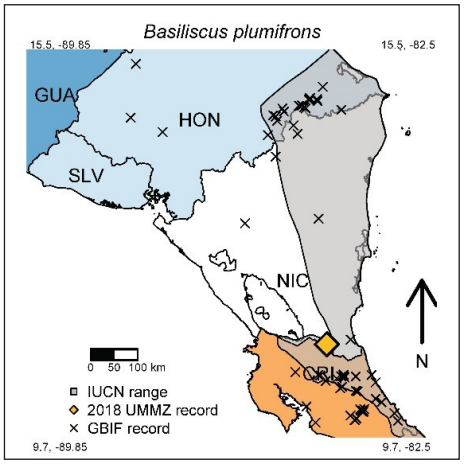

Figure A43. *Norops dariense.*

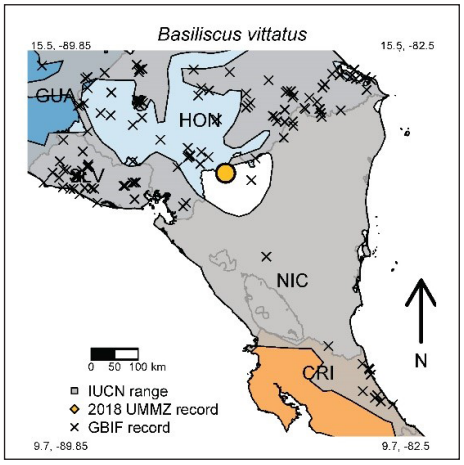

Figure A44. *Norops laeviventris.*

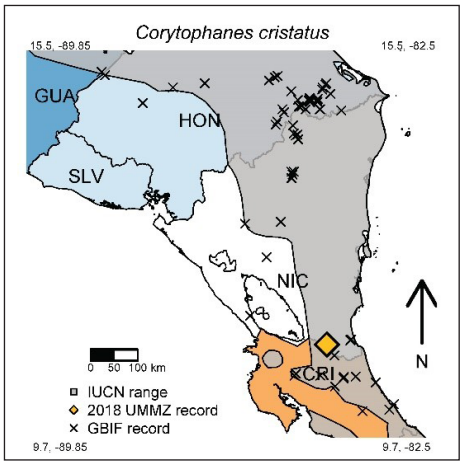

Figure A45. *Norops lemurinus.*

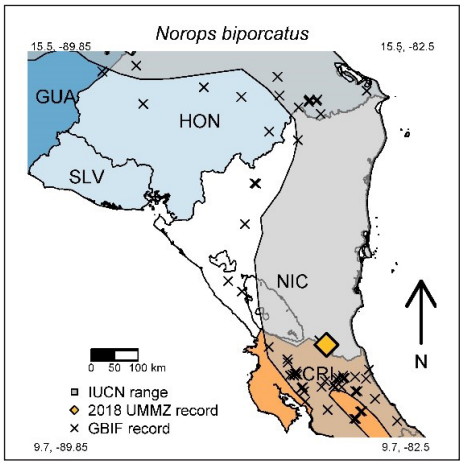

Figure A46. *Norops limifrons.*

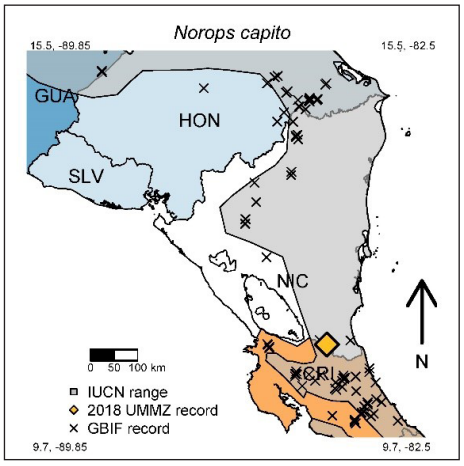

Figure A47. *Norops mccraniei.*

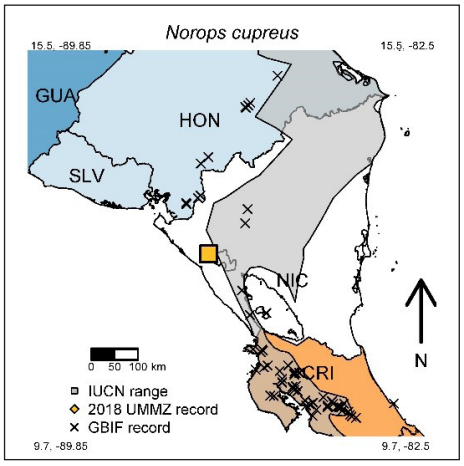

Figure A48. *Norops oxylophus.*

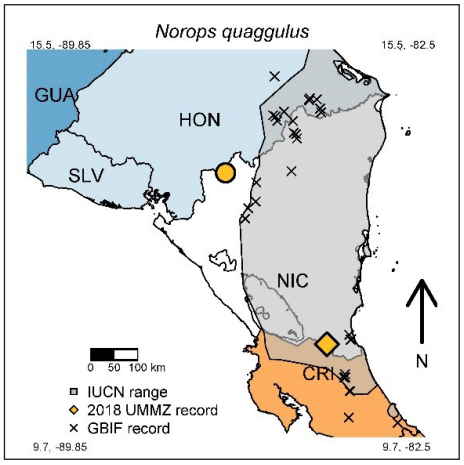

Figure A49. *Norops quaggulus.*

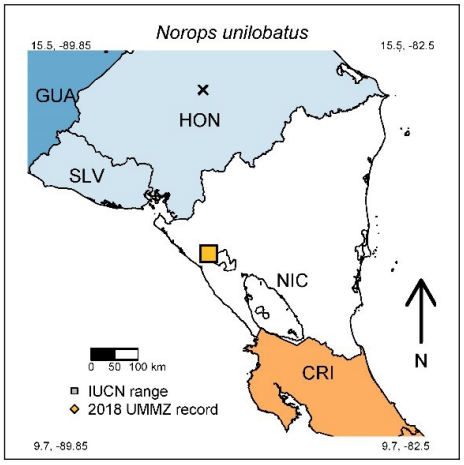

Figure A50. *Norops unilobatus.*

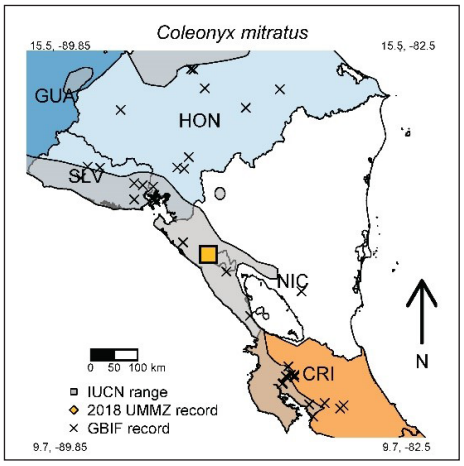

Figure A51. *Coleonyx mitratus.*

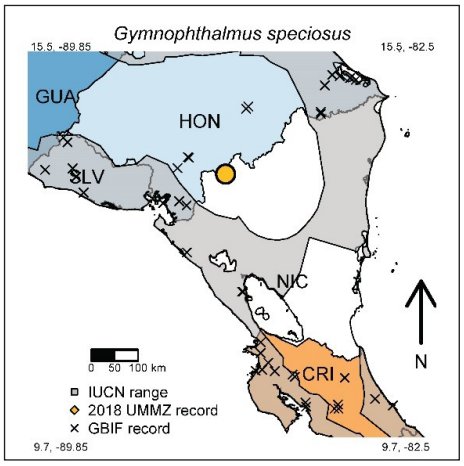

Figure A52. *Gymnophthalmus speciosus.*

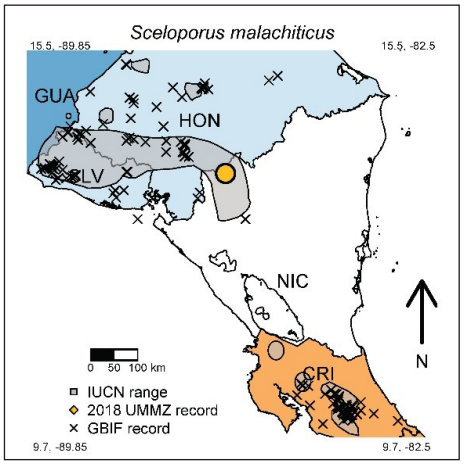

Figure A53. *Sceloporus malachiticus.*

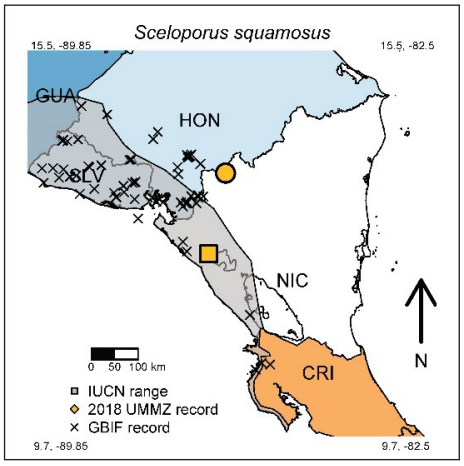

Figure A54. *Sceloporus squamosus.*

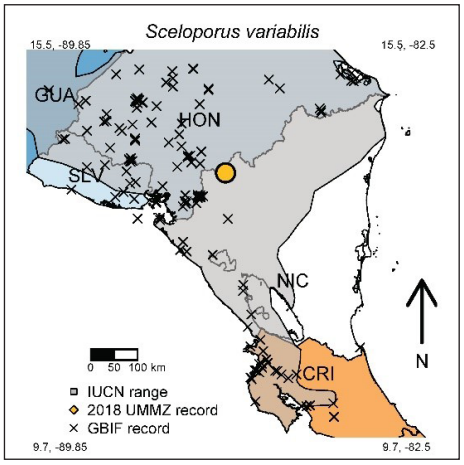

Figure A55. *Sceloporus variabilis.*

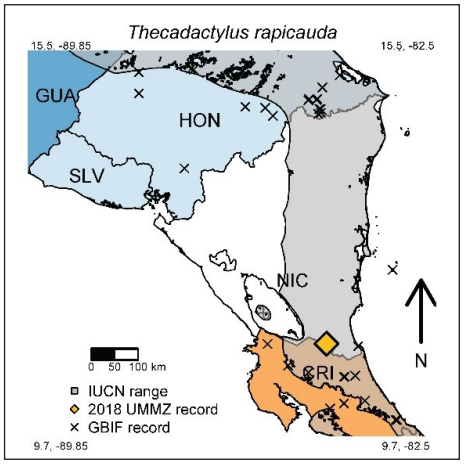

Figure A56. *Thecadactylus rapicauda.*

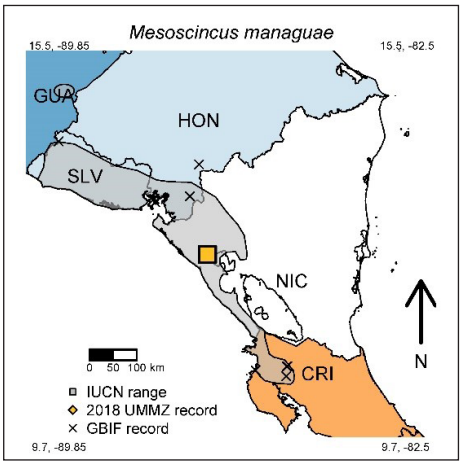

Figure A57. *Mesoscincus managuae.*

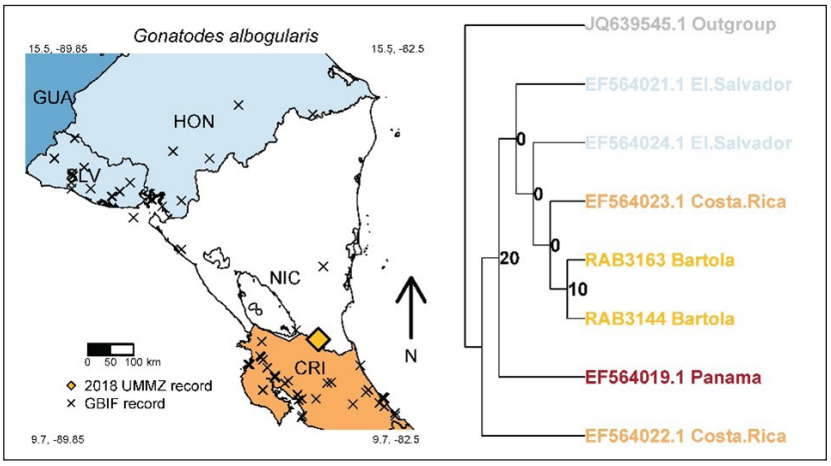

Figure A58. *Gonatodes albogularis.*

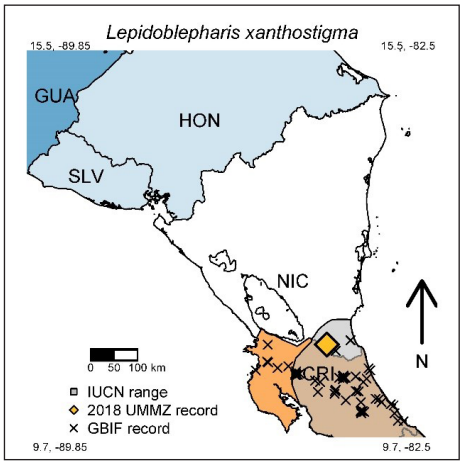

Figure A59. *Lepidoblepharis xanthostigma.*

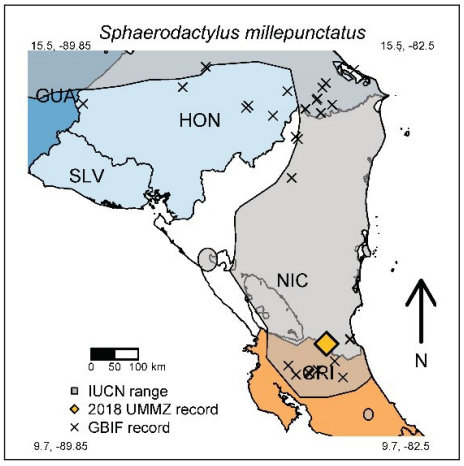

Figure A60. *Sphaerodactylus millepunctatus.*

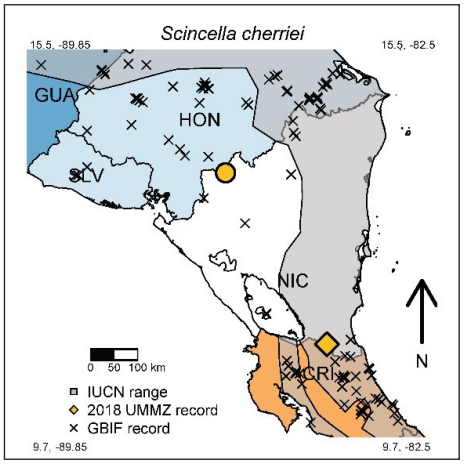

Figure A61. *Scincella cherriei.*

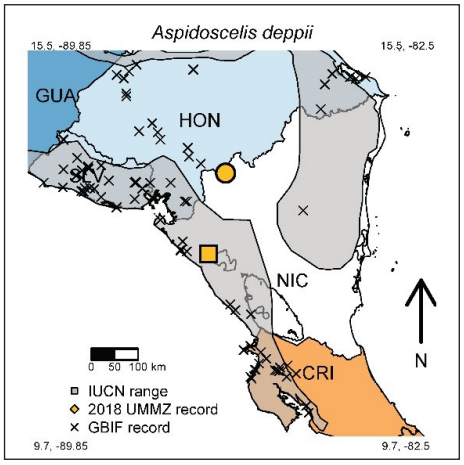

Figure A62. *Aspidoscelis deppii.*

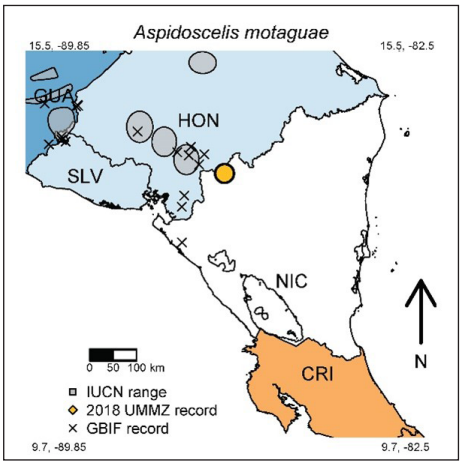

Figure A63. *Aspidoscelis motaguae.*

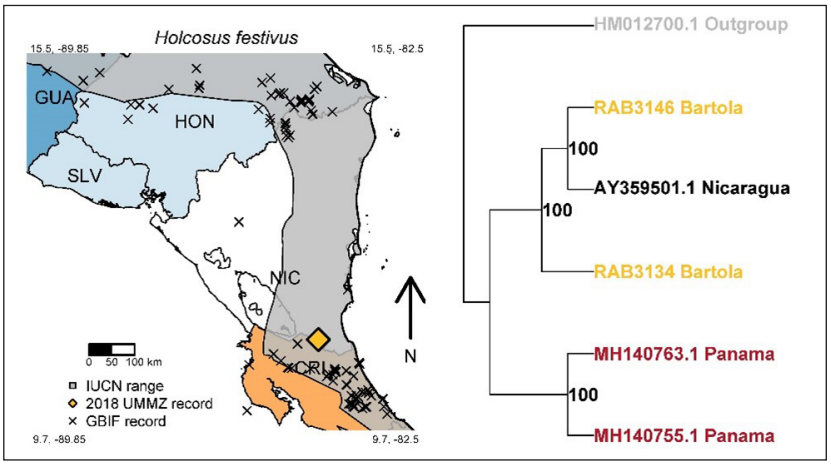

Figure A64. *Holcosus festivus.*

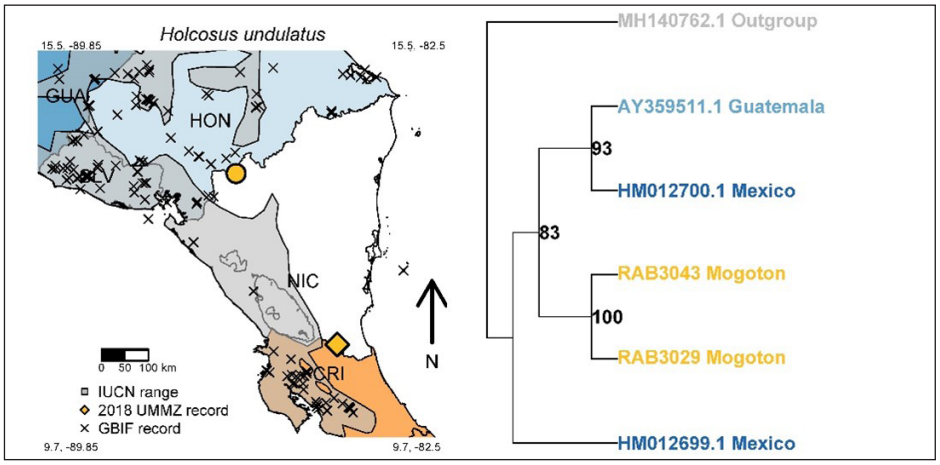

Figure A65. *Holcosus undulatus.*

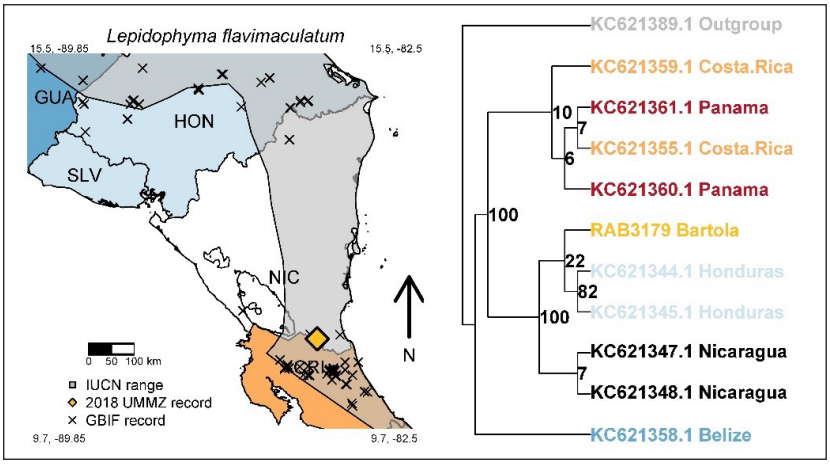

Figure A66. *Lepidophyma flavimaculatum.*

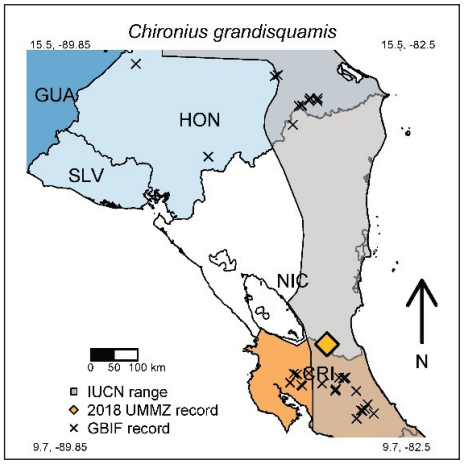

Figure A67. *Chironius grandisquamis.*

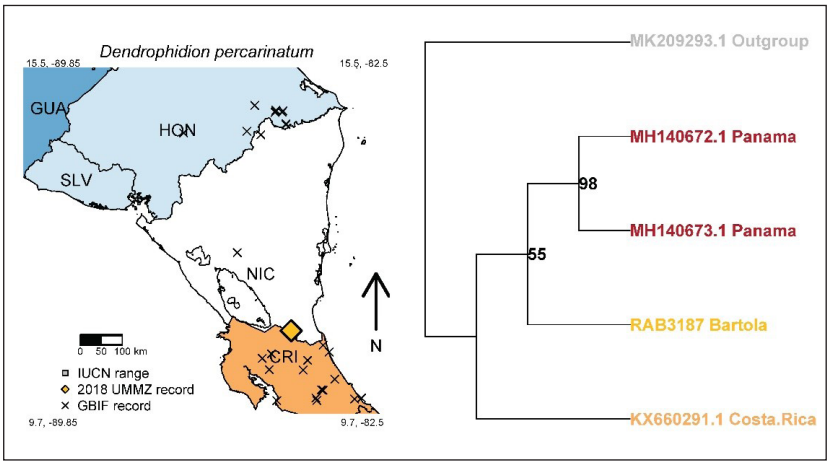

Figure A68. *Dendrophidion percarinatum.*

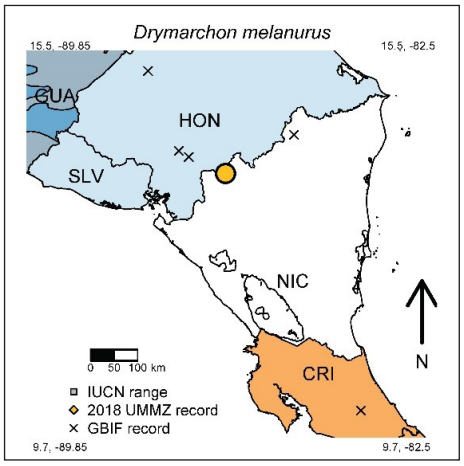

Figure A69. *Drymarchon melanurus.*

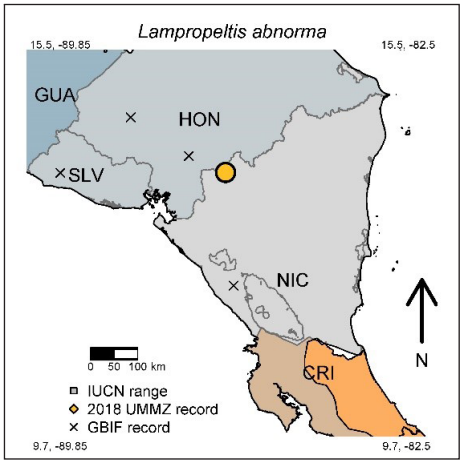

Figure A70. *Lampropeltis abnorma.*

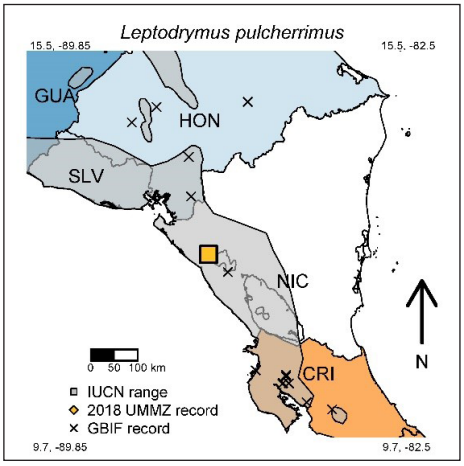

Figure A71. *Leptodrymus pulcherrimus.*

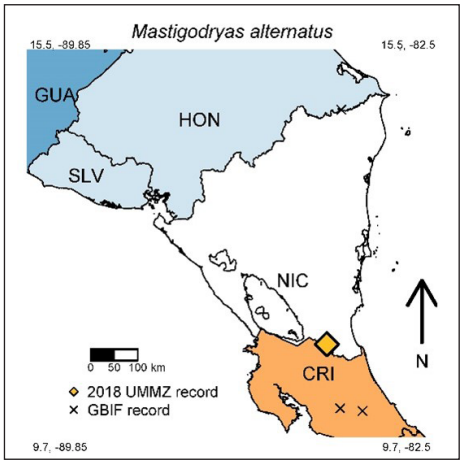

Figure A72. *Mastigodryas alternatus*.

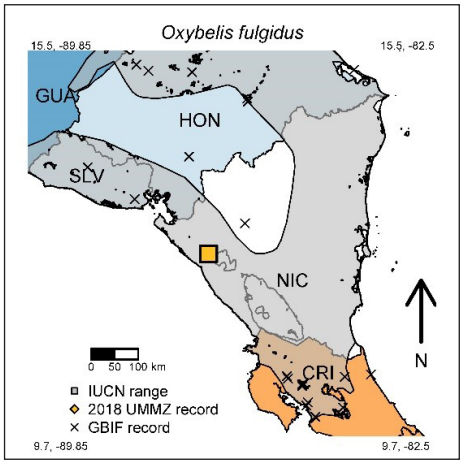

Figure A73. *Oxybelis fulgidus*.

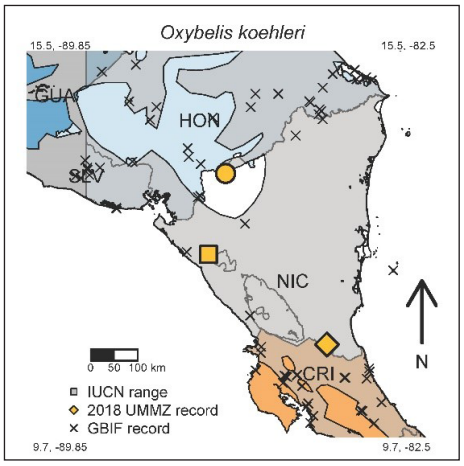

Figure A74. *Oxybelis kohleri*.

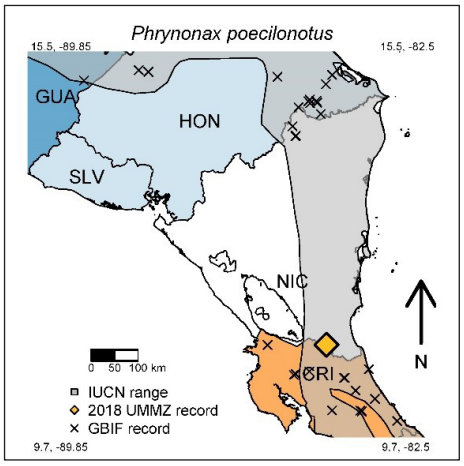

Figure A75. *Phrynonax poecilonotus*.

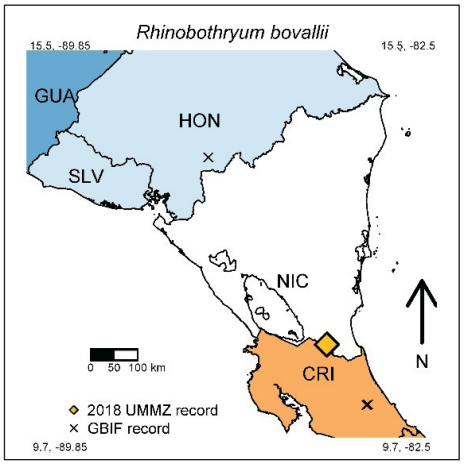

Figure A76. *Rhinobothryum bovallii*.

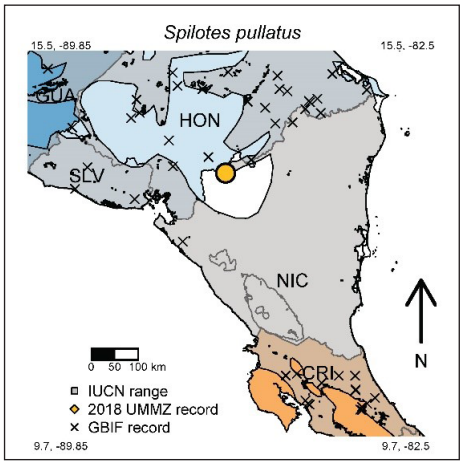

Figure A77. *Spilotes pullatus*.

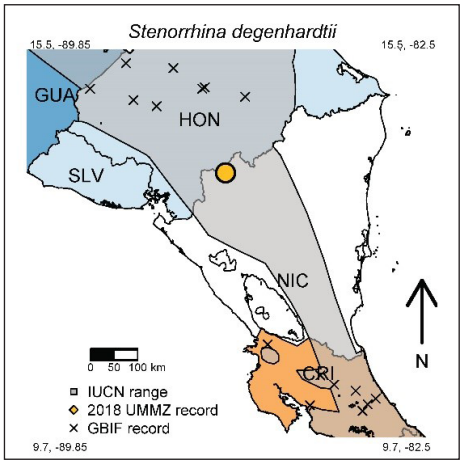

Figure A78. *Stenorrhina degenhardtii.*

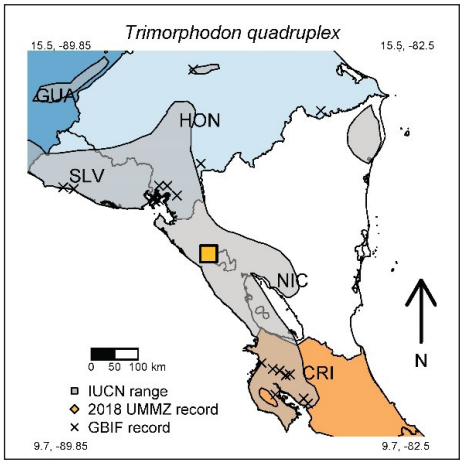

Figure A79. *Trimorphodon quadruplex.*

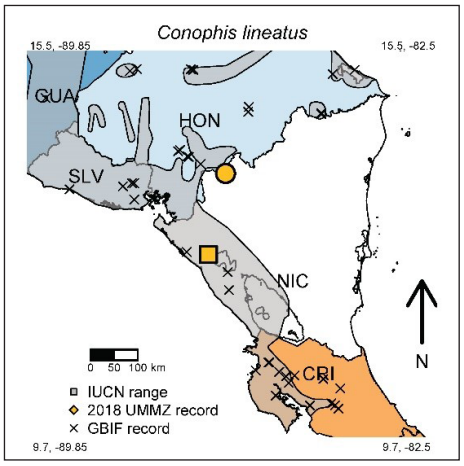

Figure A80. *Conophis lineatus.*

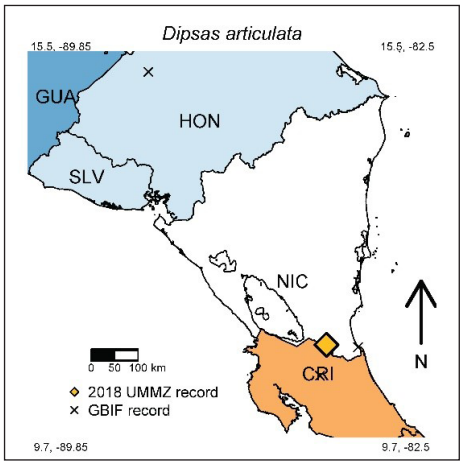

Figure A81. *Dipsas articulata.*

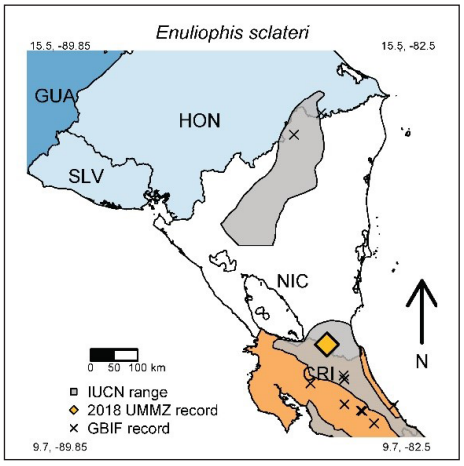

Figure A82. *Enuliophis sclateri.*

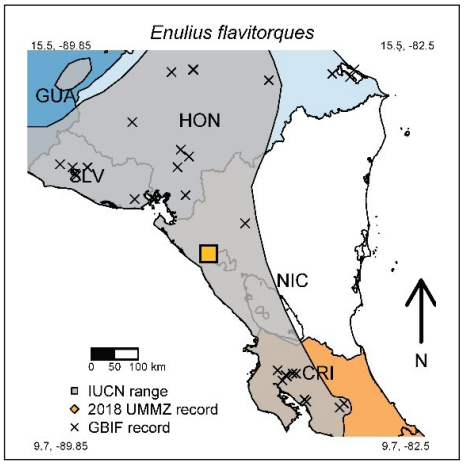

Figure A83. *Enulius flavitorques.*

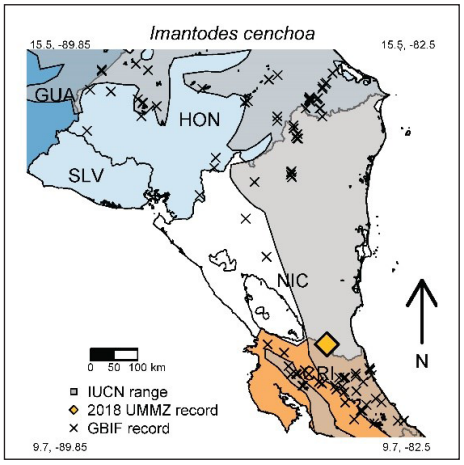

Figure A84. *Imantodes cenchoa.*

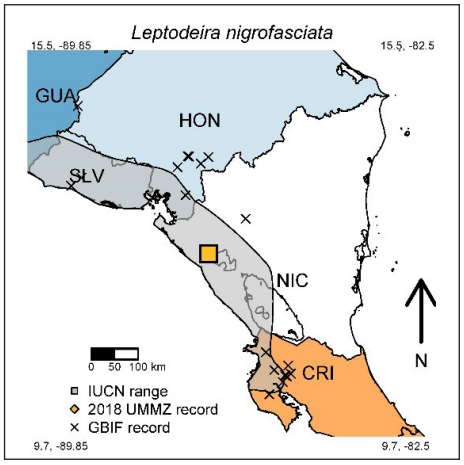

Figure A85. *Leptodeira nigrofasciata.*

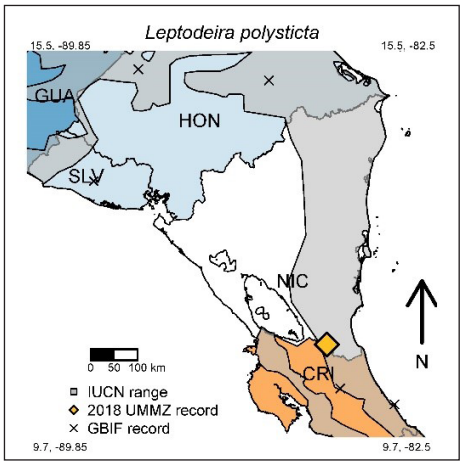

Figure A86. *Leptodeira polysticta.*

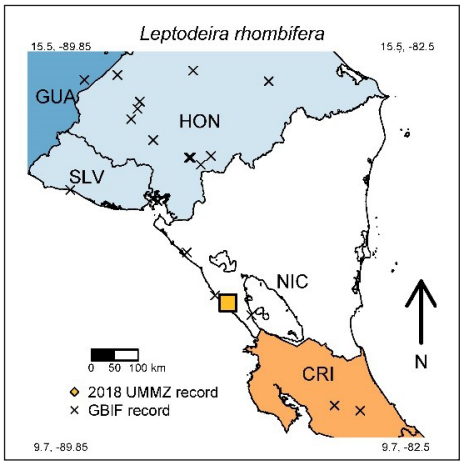

Figure A87. *Leptodeira rhombifera.*

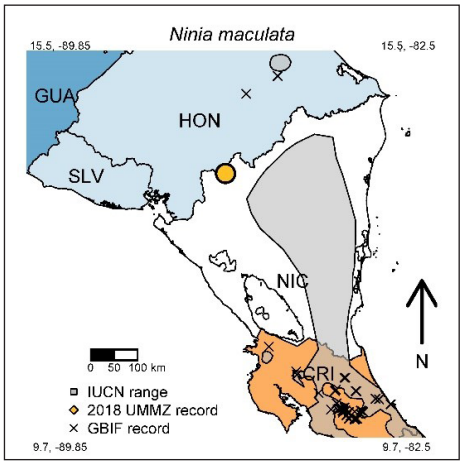

Figure A88. *Ninia maculata.*

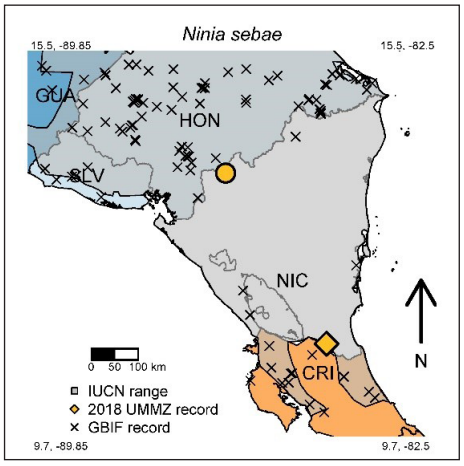

Figure A89. *Ninia sebae.*

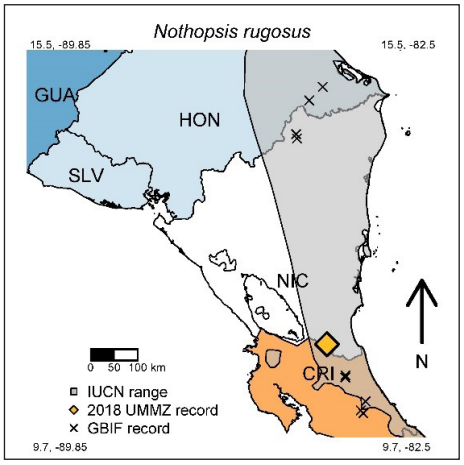

Figure A90. *Nothopsis rugosus.*

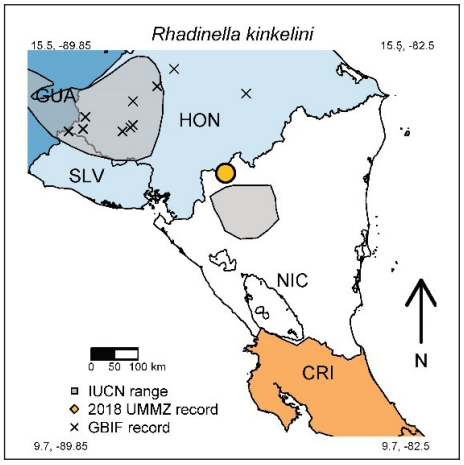

Figure A91. *Rhadinella kinkelini.*

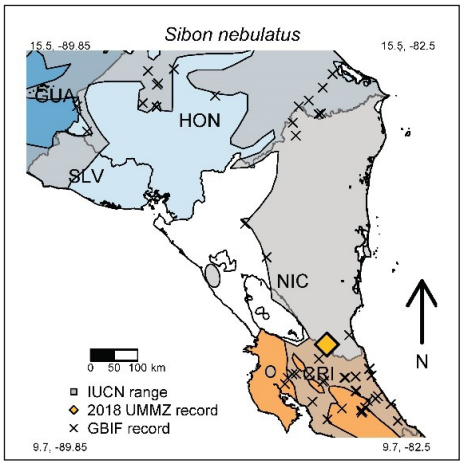

Figure A92. *Sibon nebulatus.*

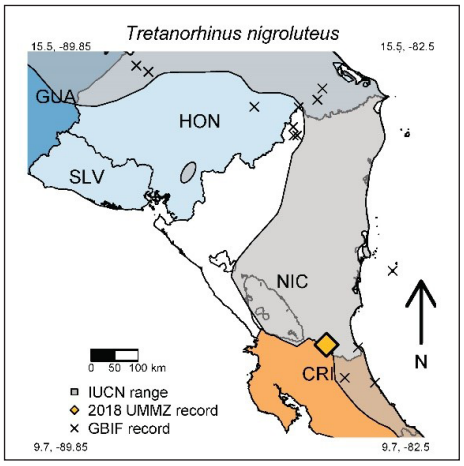

Figure A93. *Tretanorhinus nigroluteus.*

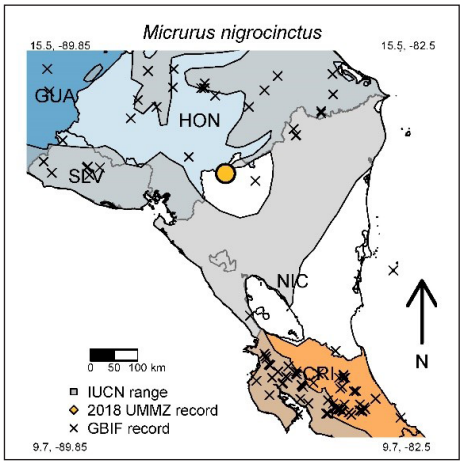

Figure A94. *Micrurus nigrocinctus.*

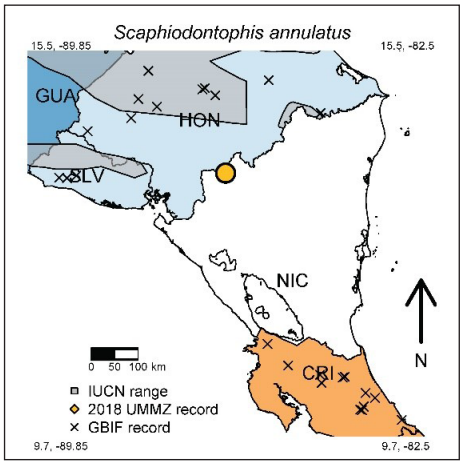

Figure A95. *Scaphiodontophis annulatus.*

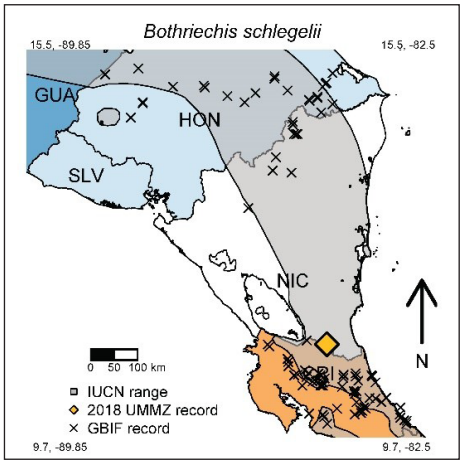

Figure A96. *Bothriechis schlegelii.*

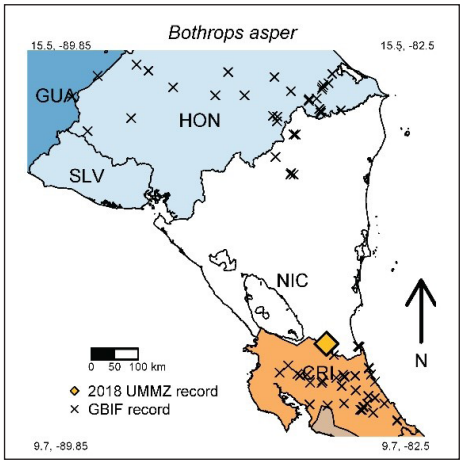

Figure A97. *Bothrops asper.*

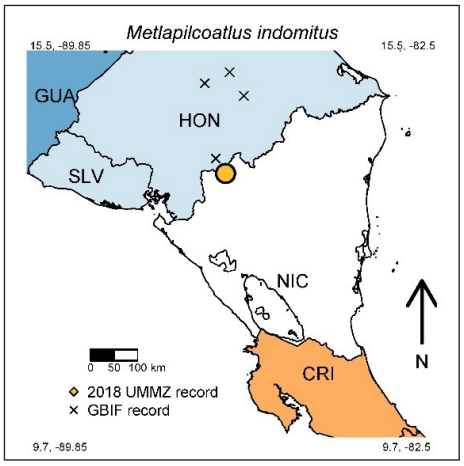

Figure A98. *Metlapilcoatlus indomitus.*

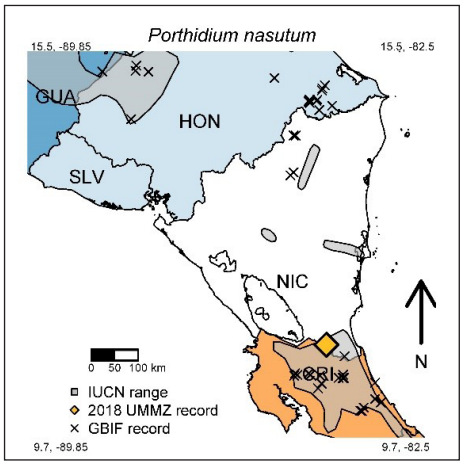

Figure A99. *Porthidium nasutum.*