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Berghe



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**Foto de Portada:** *Drymobius margaritiferus* (Foto: J.G. Martínez-Fonseca).

## The amphibians and reptiles of the department of Carazo, Central-Pacific Nicaragua

José Gabriel Martínez-Fonseca<sup>1,2,3\*</sup>, Javier Sunyer<sup>3,4</sup>, Milton Salazar-Saavedra<sup>3,4,5</sup>, Luis Gutiérrez-López<sup>2,3</sup> and Eric van den Berghe<sup>6</sup>

### RESUMEN

Proporcionamos un listado actualizado de los anfibios y reptiles del departamento de Carazo en el oeste de Nicaragua. Hacemos una revisión histórica de los registros herpetológicos del departamento y los complementamos con registros propios. Reconocemos 74 especies (17 anfibios y 57 reptiles) del departamento de Carazo (28.9% de la herpetofauna de Nicaragua), las cuales incluyen una especie de origen exótico y no incluye ninguna especie endémica de Nicaragua. Contribuimos con 14 nuevos registros departamentales para Carazo, registramos dos especies (*Sphaerodactylus millepunctatus* y *Sibon nebulatus*) por primera vez para la formación de Bosque Seco Bajo en Nicaragua, el registro más al noroeste de *Norops pentaprion*, proporcionamos fotografías de 73 especies tomadas del departamento, y brevemente discutimos el estado de conservación de todas las especies de herpetofauna presentes en el departamento. Esperamos al menos el registro de ocho especies de reptiles adicionales en el departamento de Carazo conforme se siga desarrollando investigación herpetológica.

**Palabras clave:** Biodiversidad; bosque seco; Chacocente; Chococente; herpetofauna; lista patrón.

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## ABSTRACT

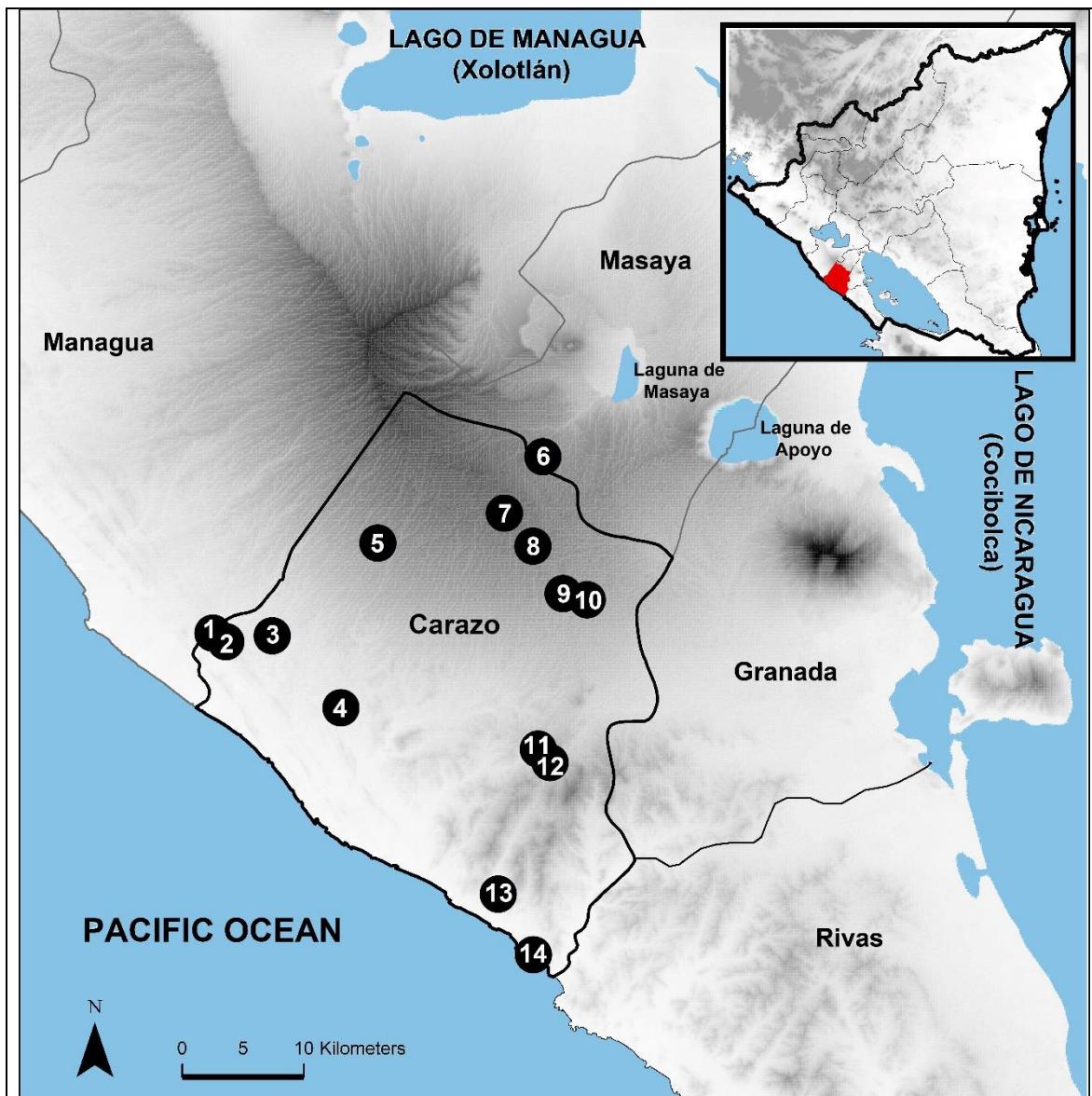
We provide an updated checklist of the amphibians and reptiles of the department of Carazo in western Nicaragua. We review the historical herpetological records from the department and complement them with our own. We record 74 species (17 amphibians and 57 reptiles) from the department of Carazo (28.9% of the herpetofauna of Nicaragua), including one species of exotic origin and no Nicaraguan endemic species. We provide 14 new departmental records for Carazo, record two species (*Sphaerodactylus millepunctatus* and *Sibon nebulatus*) for the first time in the Lowland Dry Forest formation in Nicaragua, report the northwesternmost record for *Norops pentaprion*, provide photographs taken in the department of 73 species, and briefly discuss the conservational status of the department's herpetofauna. We expect at least eight additional reptile species to be recorded from the department of Carazo as herpetological research continues developing.

**Key words:** Biodiversity; Chacocente; Chococente; checklist; dry forest; herpetofauna.

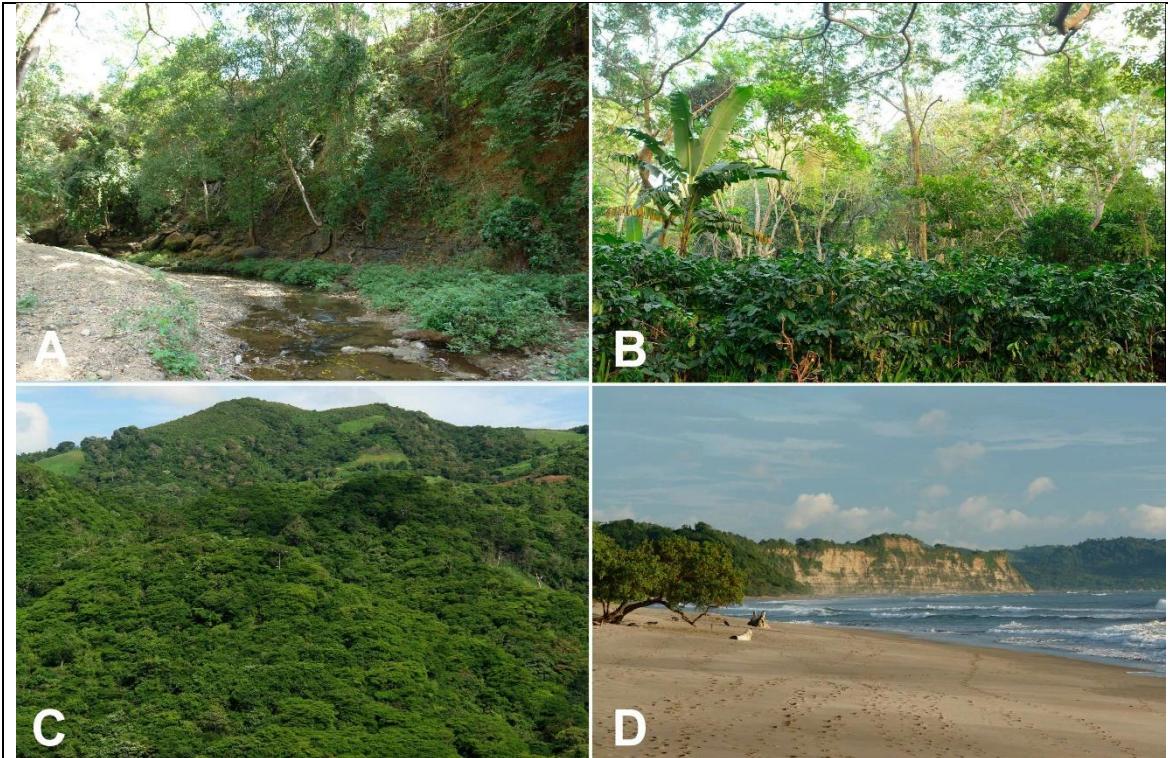
## INTRODUCTION

The department of Carazo is situated in the central portion of Pacific Nicaragua and with 1,081 km<sup>2</sup> is the third smallest of the 17 departments in the country (Incer 1998; Figure 1). Although Carazo is close to the capital of the country, Managua, and is relatively well interconnected with paved and dirt roads, the area has not yet been intensively surveyed for herpetofauna. Scattered records in the literature of amphibians and reptiles from the department is mostly compiled in Köhler (2001), and Salgado (2007) and Salazar et al. (2009) limited their herpetofaunal studies in the Refugio de Vida Silvestre Río Escalante-Chacocente, the largest protected area of the department.

There are two major forest types in the department of Carazo (Holdridge 1967; Savage 2002; Sunyer and Köhler 2010; Figure 2): most portions of the department correspond to Lowland Dry Forest (LDF), which is situated below 600 m a.s.l.; and the Premontane Dry Forest (PDF), which occurs at elevations above 600 m a.s.l. in the northeastern portion of the department. The highest elevation in the department is 870 m a.s.l. (Incer 1998) and precipitation ranges from 1,200-1,600 mm in the northern portion of the department to 800-1,200 mm in the southern portion (INIDE-MAGFOR 2013). Rains are seasonal with four or five dry months throughout the whole department. Although located at the Pacific coast of Nicaragua, Carazo is traversed by the continental divide: the western portion drains to the Pacific Ocean and the eastern portions to Lake Nicaragua, which drains to the Caribbean Sea. However, the department of Carazo does not have the influence of the Nicaraguan Great Lakes.



**Figure 1.** Map of the department of Carazo showing adjacent departments and the localities mentioned in text: 1) Comunidad de La Junta; 2) Comunidad Loma Alegre; 3) Finca El Manantial; 4) RSP La Máquina; 5) San Gregorio; 6) San Marcos; 7) RSP Finca Concepción de María; 8) Jinotepe; 9) Finca La Joya; 10) Santa Teresa; 11) Comunidad Buena Vista; 12) La Hormiga; 13) Veracruz de Acayo; and 14) RVS Río Escalante-Chacocente. Water surfaces are colored blue. In the inset map of Nicaragua, the department of Carazo is highlighted in red.



**Figure 2.** Habitat photographs from the department of Carazo: A) riparian forest in LDF; B) coffee plantation (RSP Finca Concepción de María) in PDF; C) a forest patch in LDF; and D) the beach of the RVS Río Escalante-Chacocente, in LDF. Photographs by J.G. Martínez-Fonseca.

Most portions of the department have been deeply anthropogenized and since the second half of the 20th century most of the original forests have been converted to sugar and cotton cropland in the lowlands, and coffee plantations in the upper portions (Incer 1998). Carazo has suffered from severe human pressure with a human population density of 178 persons per square kilometer in 2018 (INIDE 2018) and almost the entire area is used for subsistence agriculture and cattle farming, limiting the connectivity between remaining forest patches to living fences and some forested riverbeds, the latter having predominantly a North-to-South orientation. Coffee and sugar plantations constitute the most important agricultural activity nowadays, and artisanal fisheries constitute a common subsistence activity along the coastline (INIDE-MAGFOR 2013). In recent years, large textile factories and tract housing have added to the habitat fragmentation in the coffee growing areas.

There is a single protected area that belongs to the national protected areas system (Sistema Nacional de Áreas Protegidas or SINAP) in the department of Carazo, the Wildlife Refuge or Refugio de Vida Silvestre (RVS) Río Escalante-Chacocente (MARENA 2007; Figure 1; Figure 2C, D). With 4,600 hectares, this area holds the largest and best protected forest patch of LDF in the entire country. It is additionally recognized as one of the two beaches in Nicaragua that experience massive sea turtle nesting events (together with the RVS La Flor in the department of Rivas), and one of few such beaches in the world. These nestings events, locally known as “arribadas” (Gonzales 2001), are a spectacular phenomenon involving several dozen to tens of thousands of adult female Olive Ridley Sea Turtles (*Lepidochelys olivacea*) nesting synchronously for several successive nights. Additionally, the department of Carazo also has three private protected areas or Reservas Silvestres Privadas (RSP): RSP Finca Concepción de María; RSP La Máquina; and RSP Finca La Alemania. Two of these were old shade coffee plantations situated in the higher northeastern portions of the department whereas the third, RSP La Máquina, corresponds to LDF and possesses a permanent stream. The combined area of all three RSPs in the department is ca. 416 hectares (Rueda Pereira 2007; La Gaceta, 2012).

As a curiosity aside, the department of Carazo is the birth place of Clodomiro Picado, a notorious scientist who implemented and developed important breakthroughs in ophidism (among several other scientific fields), mostly in Costa Rica.

The purpose of this contribution is to gather in a single document the herpetofaunal checklist of the department of Carazo, including records from literature as well as our own.

## METHODS

The study area corresponds to the department of Carazo, situated in central Pacific Nicaragua and bordering the departments of Managua, Masaya, Granada, and Rivas, as well as the Pacific Ocean (Figure 1). Dozens of opportunistic field searches were made from 2005-2017, mostly to 14 localities within the department of Carazo (Figure 1). Animals were photographed (Figures 3-12) and handled on site, but with few exceptions not collected. For classification we follow Sunyer (2014) with the following exceptions: *Rhinella horribilis* over *R. marina* (Acevedo-Rincón et al. 2016); *Coluber mentovarius* over *Masticophis mentovarius* (McCranie 2011); *Trachemys emolli* over *T. grayi* (McCranie In Press); and *Kinosternon albogulare* over *K. scorpioides* (McCranie In Press). For species identification we mostly followed Villa (1972, 1984), Köhler (2001, 2008, 2011), Savage (2002), Ruiz Pérez and Buitrago (2003), and HerpetoNicas (2015). Geographical coordinates are based on WGS84 datum.

## RESULTS AND DISCUSSION

As listed in Table 1 and detailed in the following species accounts, the herpetofauna of the department of Carazo as documented herein includes 74 species (28.9% of the herpetofauna of Nicaragua; Salazar-Saavedra et al. 2015, 2018; Fernández et al. 2017; Loza et al. 2017; McCranie 2017; Gutiérrez-Rodríguez and Sunyer 2016; Phillips et al. 2015; Villa 2015; Sunyer 2014) corresponding to 63 genera and 30 families, of which 17 species (16 anurans and 1 caecilian), 14 genera, and 8 families are amphibians and 57 species (20 lizards, 31 snakes, and 6 turtles), 49 genera, and 22 families are reptiles. All these species are terrestrial with the exception of 5 marine species (4 sea turtles and one sea snake). So far, no Nicaraguan endemic species has been recorded and there is only one species of exotic origin: *Hemidactylus frenatus*.

We add 14 new departmental records (four amphibians and ten reptiles) to the previously documented herpetofauna of Carazo: 1) *Incilius luetkenii*; 2) *Dendropsophus microcephalus*; 3) *Leptodactylus fragilis*; 4) *Rhinophryne dorsalis*; 5) *Norops pentaprion*; 6) *Sceloporus squamosus*; 7) *Sphaerodactylus millepunctatus*; 8) *Leptophis mexicanus*; 9) *Oxybelis fulgidus*; 10) *Senticolis triaspis*; 11) *Crisantophis nevermanni*; 12) *Imantodes gemmistratus*; 13) *Sibon nebulatus*; and 14) *Loxocemus bicolor*. We record the northwesternmost locality of *Norops pentaprion*, a species otherwise known to occur as far north as the department of Matagalpa in the central portions of the country and the south Atlantic drainage of Nicaragua (Köhler 2010; Gutiérrez-Rodríguez et al. 2016). We additionally record two species for the first time in LDF in Nicaragua (Sunyer and Köhler 2010): *Sphaerodactylus millepunctatus* and *Sibon nebulatus*. Both of these species are known from a nearby PDF locality in the department of Managua (Köhler 2001).

Except for *Geophis hoffmanni* and *Eretmochelys imbricata*, which we list merely based on references, we personally observed all species mentioned in Table 1 in the department of Carazo. We additionally include pictures that were taken within the department for all species (Figures 3-12) except for *G. hoffmanni*, for which we provide a photograph from the department of Río San Juan, southeastern Nicaragua.

## SPECIES ACCOUNT

**Class Amphibia**

**Order Anura**

**Family Bufonidae**

*Incilius coccifer* (Cope, 1866): Figure 3A. Southern Roundgland Toad; Sapo enano.

Finca El Manantial, Comunidad de Los Velázquez, Municipio de Diriamba (11.77112°N, 86.38182°W); elev. 92 m; 26 September 2010. José G. Martínez-Fonseca and Luis Gutiérrez-López.

This species has previously been reported from the department by Salazar et al. (2009). It is a relatively common species throughout the department, particularly in crop fields and secondary forest patches in the lowlands of the municipalities of Diriamba and Santa Teresa.

*Incilius luetkenii* (Boulenger, 1891): Figure 3B. Yellow Toad; Sapo amarillo.

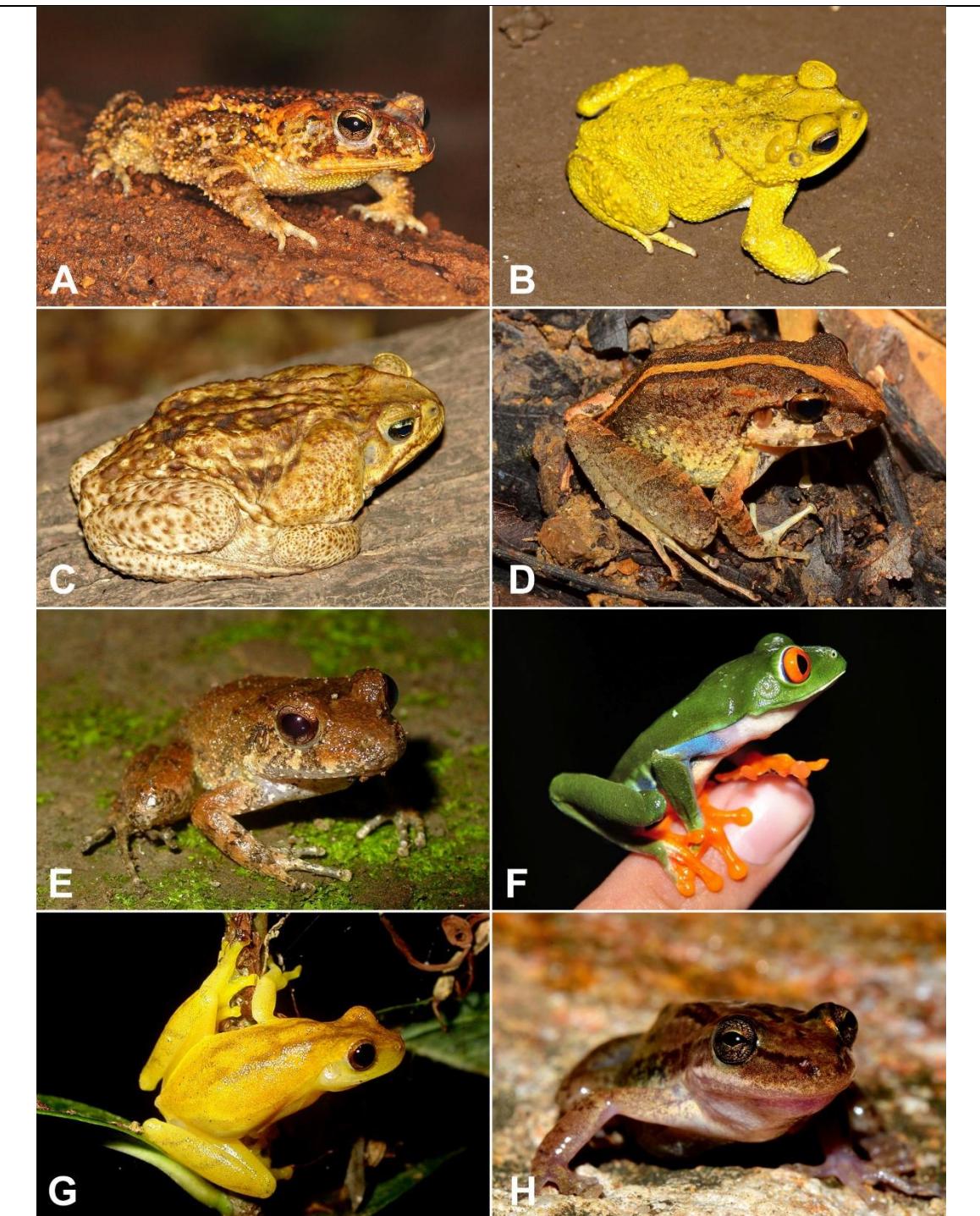
Finca La Joya, Municipio de Santa Teresa (11.79772°N, 86.14878°W); elev. 376 m; 14 April 2007. José G. Martínez-Fonseca.

We found an adult male at 1600 h while active in a pasture within a citric plantation. Although this species is rather common in the department and occurs both in forest patches as well as in anthropogenized areas, including the margins of towns and cities, it has not been formally reported previously for the department, and therefore constitutes a new departmental record. Sunyer (2014) misspelled this species name in his herpetological Nicaraguan checklist.

*Rhinella horribilis* (Linnaeus, 1758): Figure 3C. Cane Toad; Sapo común.

RVS Río Escalante-Chacocente, near the estuary of Veracruz de Acayo (11.56176°N, 86.22570°W); elev. 8 m; 24 March 2007. José G. Martínez-Fonseca.

This species has previously been reported from the department by Köhler (2001), Ruiz Pérez and Buitrago (2003), and Salazar et al. (2009). It is a very common species throughout the department, including urban areas.



**Figure 3.** A) *Incilius coccifer* from Finca El Manantial; B) *Incilius luetkenii* from Finca La Joya; C) *Rhinella horribilis* from RVS Río Escalante-Chacocente; D) *Craugastor fitzingeri* from Finca La Joya; E) *Craugastor laevissimus* from RVS Río Escalante-Chacocente; F) *Agalychnis callidryas* and G) *Dendropsophus microcephalus* from RSP Finca Concepción de María; and H) *Scinax staufferi* from RVS Río Escalante-Chacocente. Photographs A-D, F by J.G. Martínez-Fonseca; E, G-H by M. Salazar-Saavedra.

### Family Craugastoridae

*Craugastor fitzingeri* (Schmidt, 1857): Figure 3D. Fitzinger's Robber Frog; Rana selvática de Fitzinger.

Finca La Joya, 2 km SE from Santa Teresa (11.79948°N, 86.14786°W); elev. 376 m; 30 December 2011. José G. Martínez-Fonseca.

This species has previously been reported from the department by Köhler (2001) and Ruiz Pérez and Buitrago (2003). It is a relatively uncommon species in the department, where it is exclusively known from well-preserved forests.

*Craugastor laevissimus* (Werner, 1896): Figure 3E. Robber Frog; Rana hojarasquera.

RVS Río Escalante-Chacocente, Municipio de Santa Teresa (11.56627°N, 86.148034°W); elev. 45 m; 7 March 2009. Milton Salazar-Saavedra.

This endangered species has previously been reported from the department by Köhler (2001) and Ruiz Pérez and Buitrago (2003). It is a relatively uncommon species in the department, where it is exclusively known from well-preserved forests.

### Family Hylidae

*Agalychnis callidryas* (Cope, 1862): Figure 3F. Red-eyed Treefrog; Rana ojos rojos.

RSP Finca Concepción de María, Municipio de Dolores (11.86160°N, 86.21200°W); elev. 600 m; 2 September 2010. José G. Martínez-Fonseca and Milton Salazar-Saavedra.

This species has previously been reported from the department by Sunyer et al. (2014a) and HerpetoNicas (2015). It is a relatively uncommon species in the department whose distribution seems to be related to shade coffee plantations, where it can be locally abundant.

*Dendropsophus microcephalus* (Cope, 1886): Figure 3G. Small-headed Treefrog; Ranita grillo.

RSP Finca Concepción de María, Municipio de Dolores (11.86159°N, 86.21202°W); elev. 600 m; 29 June 2011. Milton Salazar-Saavedra.

We photographed an adult of this species (Figure 3G) while it was active at night in a mature shade coffee plantation. New departmental record.

***Scinax staufferi* (Cope, 1865): Figure 3H. Stauffer's Treefrog; Ranita de Stauffer.**

RVS Río Escalante-Chacocente, Comunidad El Escondido ( $11.57514^{\circ}\text{N}$ ,  $86.19561^{\circ}\text{W}$ ); elev. 74 m; and Veracruz de Acayo ( $11.57635^{\circ}\text{N}$ ,  $86.21404^{\circ}\text{W}$ ); elev. 22 m; 25 November 2006. Milton Salazar-Saavedra.

This species has previously been reported from the department by Salazar et al. (2009). It is a relatively common species throughout the department.

***Smilisca baudinii* (Duméril & Bibron, 1841): Figure 4A. Common Mexican Treefrog; Rana arbórea común.**

Road from Santa Teresa to El Calishuate ( $11.80342^{\circ}\text{N}$ ,  $86.15166^{\circ}\text{W}$ ); elev. 392 m; 25 June 2013. José G. Martínez-Fonseca.

This species has previously been reported from the department by Köhler (2001) and Ruiz Pérez and Buitrago (2003). It is a very common species throughout the department, including forested, altered, and urban habitats.

***Trachycephalus typhonius* (Linnaeus, 1758): Figure 4B. Veined Frog; Rana lechosa.**

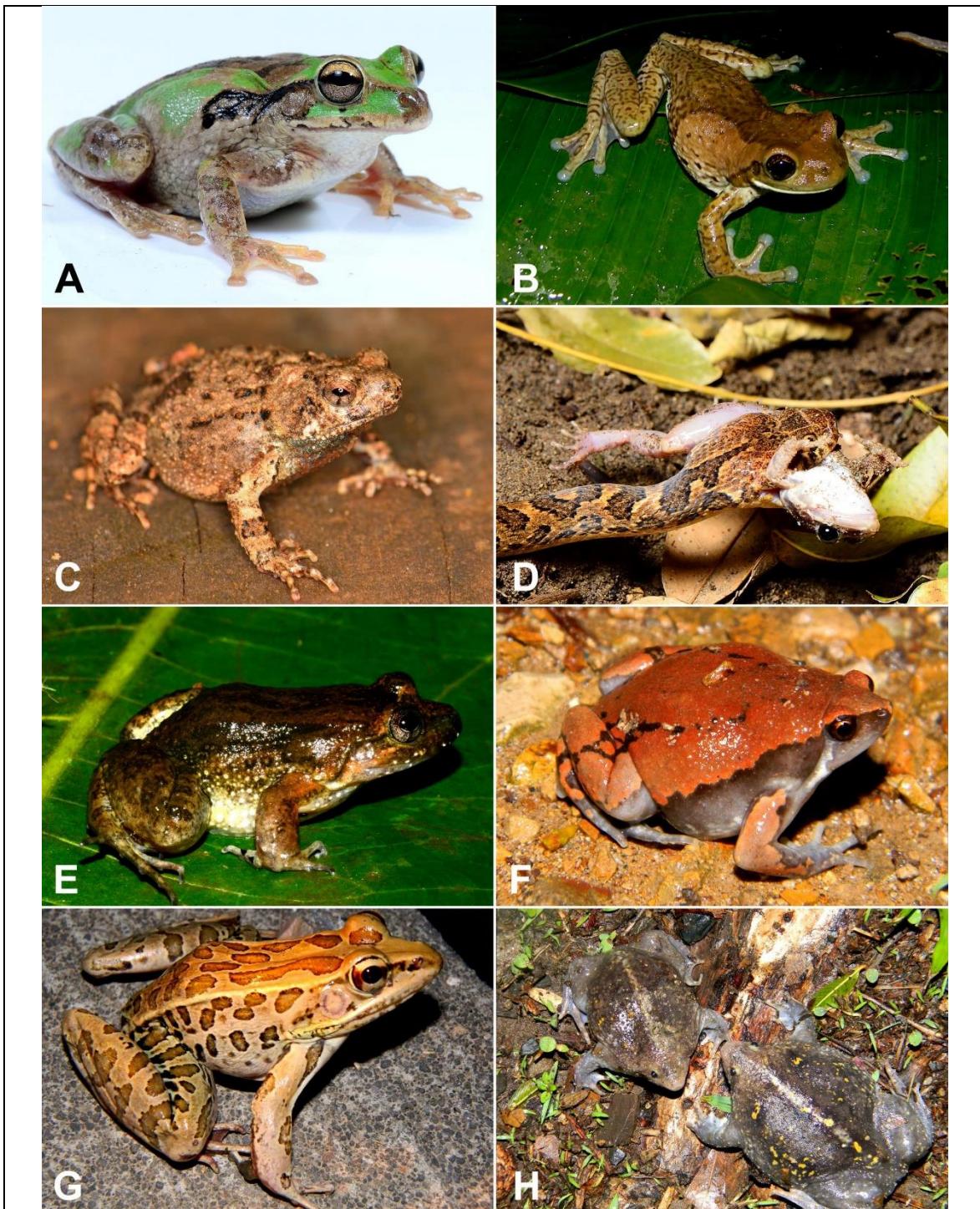
This species is known from the department of Carazo from a single individual (Figure 4B) previously published in HerpetoNica (2015) and Sunyer et al. (2014a) from RSP Finca Concepción de María. The latter reference erroneously reported it to have been encountered at 132 m elevation, whereas the individual was actually found at 576 m elevation.

#### **Family Leptodactylidae**

***Engystomops pustulosus* (Cope, 1864): Figure 4C. Tungara Frog; Sapito Túngara.**

Finca La Joya, Municipio de Santa Teresa ( $11.79950^{\circ}\text{N}$ ,  $86.14789^{\circ}\text{W}$ ); elev. 374 m; 30 July 2011. José G. Martínez-Fonseca.

This species has previously been reported from the department by Köhler (2001), Ruiz Pérez and Buitrago (2003), Salazar et al. (2009), and HerpetoNicas (2015). It is a very common species throughout the department, including forested, altered, and urban habitats.



**Figure 4.** A) *Smilisca baudinii* from Road Santa Teresa-El Calishuate; B) *Trachycephalus typhonius* from Finca Concepción de María; C) *Engystomops pustulosus* from Finca La Joya; D) *Leptodactylus fragilis* from Loma Alegre; E) *Leptodactylus melanotus* from RSP Finca Concepción de María; F) *Hypopachus variolosus* from RVS Río Escalante-Chacocente; G) *Lithobates forreri* from Veracruz de Acayo; and H) *Rhinophryne dorsalis* from RSP Finca Concepción de María. Photographs A, C-D by J.G. Martínez-Fonseca; B, E-H by M. Salazar-Saavedra.

***Leptodactylus fragilis*** (Brocci, 1877): Figure 4D. American White-lipped Frog; Ranita de charco labiblanca.

Comunidad Loma Alegre, Municipio de Diriamba ( $11.77303^{\circ}\text{N}$ ,  $86.42570^{\circ}\text{W}$ ); elev. 55m; 4 January 2017. José G. Martínez-Fonseca and Luis E. Gutiérrez-López.

We found an adult individual being hunted and swallowed by a *Leptodeira rhombifera* (Figure 4D) at nighttime along a riverbank. The prey emitted a couple of loud and distorted vocalizations before being swallowed. New departmental record.

***Leptodactylus melanotus*** (Hallowell, 1861): Figure 4E. Sabinal Frog; Rana de charco común.

RSP Finca Concepción de María, Municipio de Dolores ( $11.86178^{\circ}\text{N}$ ,  $86.20999^{\circ}\text{W}$ ); elev. 600 m; 11 December 2010. Milton Salazar-Saavedra.

This species has previously been reported from the department by Köhler (2001), Ruiz Pérez and Buitrago (2003), and HerpetoNicas (2015). It is a very common species throughout the department, including forested and altered habitats.

### Family Microhylidae

***Hypopachus variolosus*** (Cope, 1866): Figure 4F. Mexican Narrow-mouthed Toad; Rana cabro.

RVS Río Escalante-Chacocente, Río Escalante ( $11.56680^{\circ}\text{N}$ ,  $86.15015^{\circ}\text{W}$ ); elev. 78 m; 2 May 2010. Milton Salazar-Saavedra.

This species has previously been reported from the department by Villa (1972) and Nelson (1974). It is a relatively uncommon species in the department, where it is only known from well-preserved forests.

### Family Ranidae

***Lithobates forreri*** (Boulenger, 1883): Figure 4G. Forrer's Grass Frog; Rana leopardo.

Veracruz de Acayo ( $11.57992^{\circ}\text{N}$ ,  $86.21456^{\circ}\text{W}$ ); elev. 50 m; 21 November 2006. Milton Salazar-Saavedra.

This species has previously been reported from the department by Salgado (2007) and Salazar et al. (2009). It is a relatively uncommon species known from forested habitats in the department.

**Family Rhinophrynidae**

*Rhinophryne dorsalis* (Duméril & Bibron, 1841): Figure 4H. Burrowing Toad; Sapo borracho.

RSP Finca Concepción de María, Municipio de Dolores (11.86207°N, 86.20929°W); elev. 596 m; 2 May 2010. Milton Salazar-Saavedra.

We found an adult couple of this species (Figure 4H) while we were digging in the ground in a shade coffee plantation. New departmental record.

**Order Gymnophiona**

**Family Dermophiidae**

*Dermophis mexicanus* (Duméril & Bibron, 1841): Figure 5A. Mexican Caecilian; Suelda con suelda.

Municipio de San Marcos (11.90361°N, 86.18152°W); elev. 486 m; 10 October 2008. Eric van den Berghe.

This species has previously been reported from the department by Salazar et al. (2009). It is relatively uncommon in the department, where it is known from both forested and altered habitats.

**Class Reptilia**

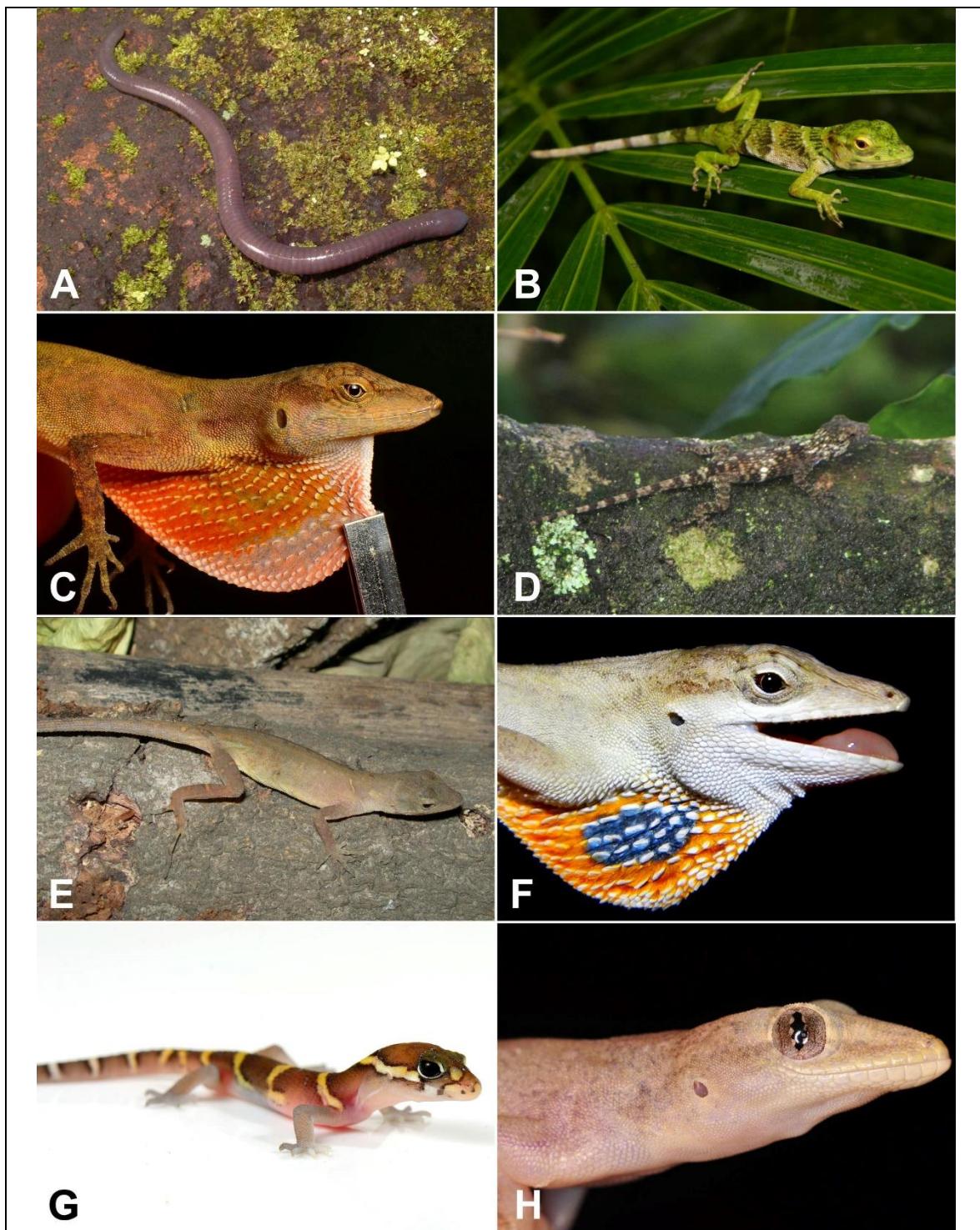
**Order Squamata - Lizards**

**Family Dactyloidae**

*Norops biporcatus* (Wiegmann, 1834): Figure 5B. Neotropical Green Anole; Cherepo verde gigante.

RSP Finca Concepción de María, Municipio de Dolores (11.86104°N, 86.20935°W); elev. 589 m; 3 September 2009. Milton Salazar-Saavedra.

This species has previously been reported from the department by Salgado (2007) and Salazar et al. (2009). It is a relatively uncommon species in the department and its distribution seems to be restricted to forested habitats.



**Figure 5.** A) *Dermophis mexicanus* from San Marcos; B) *Norops biporcatus* from RSP Finca Concepción de María; C) *Norops cupreus* from Jinotepe; D) *Norops pentaprion* from San Marcos; E) *Norops quaggulus* from Finca La Joya; F) *Norops unilobatus* from RVS Río Escalante-Chacocente; G) *Coleonyx mitratus* and H) *Hemidactylus frenatus* from Santa Teresa. Photographs A, D by E. van den Berghe; B, F by M. Salazar-Saavedra; C, E, G-H by J.G. Martínez-Fonseca.

***Norops cupreus* (Hallowell, 1861): Figure 5C. Copper Anole; Cherepo común.**

Southern portion of the city of Jinotepe ( $11.83746^{\circ}\text{N}$ ,  $86.18894^{\circ}\text{W}$ ); elev. 521 m; 16 November 2011. José G. Martínez-Fonseca.

This species has previously been reported from the department by Köhler (2001) and Salazar et al. (2009). It is a very common species along the remaining forest patches of the department.

***Norops pentaprion* (Cope, 1862): Figure 5D. Lichen Anole; Cherepo impostor.**

Finca Las Orquídeas, Municipio de San Marcos, ( $11.9152^{\circ}\text{N}$ ,  $86.18333^{\circ}\text{W}$ ); elev. 660 m; 11 March 2010. Eric van den Berghe.

A juvenile individual was perched about 2 m above ground on a branch of a citrus tree in an old shade coffee plantation. It therefore had no dewlap, which is the morphological characteristic that distinguish this species with *N. charlesmyersi*, a species known from the pacific versant of Costa Rica and western Panama (Köhler 2010). Given the relative proximity of the Carazo proximity to Volcán Mombacho and in a lesser degree to Ometepe Island, both localities where *N. pentaprion* has been reported, we believe this to be the northernmost record of distribution on the Pacific versant, extending its known distribution range 25 km NW from its closest published record (Volcán Mombacho, department of Granada; Köhler 2010), as well as a new departmental record for Carazo. *Norops pentaprion* is otherwise known to occur as far north as the department of Matagalpa in the central portions of the country and the south Atlantic drainage of Nicaragua (Köhler 2010; Gutiérrez-Rodríguez et al. 2016).

***Norops quaggulus* (Cope, 1885): Figure 5E. Humble Anole; Cherepo terrestre pequeño.**

Finca La Joya, Municipio de Santa Teresa ( $11.79950^{\circ}\text{N}$ ,  $86.14789^{\circ}\text{W}$ ); elev. 374 m; 28 September 2006. José G. Martínez-Fonseca.

This species has previously been reported from the department by Ruiz Pérez and Buitrago (2003), HerpetoNica (2015), and Phillips et al. (2015), who suggested doing genetic corroboration of all the Pacific populations of this species in Nicaragua to verify if they actually correspond to *N. quaggulus* or *N. humilis*. It is a relatively uncommon species in the department and associated with forested habitats.

***Norops unilobatus* (Köhler & Veselý, 2010): Figure 5F. Silky Anole; Cherepo amarillo.**

RVS Río Escalante-Chacocente, Veracruz ( $11.57635^{\circ}\text{N}$ ,  $86.21404^{\circ}\text{W}$ ); elev. 37 m; 23 November 2006; and Wiste ( $11.59060^{\circ}\text{N}$ ,  $86.26614^{\circ}\text{W}$ ); elev. 56 m; 24 November 2006. Milton Salazar-Saavedra.

This species has previously been reported from the department by Salgado (2007) and Salazar et al. (2009). It is a relatively common species in the department, where it occurs both in forested and open habitats.

### Family Eublepharidae

*Coleonyx mitratus* (Peters, 1863): Figure 5G. Central American Banded Gecko; Perrozompopo atigrado.

Near Santa Teresa, Municipio de Santa Teresa (11.81852°N, 86.15894°W); elev. 438 m; 12 June 2014. José G. Martínez-Fonseca.

This species has previously been reported from the department by Salazar et al. (2009) and Sunyer et al. (2017). This beautiful species is erroneously believed to be venomous to humans and animals and is therefore killed at sight by local people. Although this is a relatively common species in the department, especially in burrows of leafcutter ant colonies, it is not often seen.

### Family Gekkonidae

*Hemidactylus frenatus* (Schlegel, 1836): Figure 5H. Common House Gecko; Perrozompopo común.

Santa Teresa, Municipio de Santa Teresa (11.80330°N, 86.16443°W); elev. 406 m; 2 July 2010. José G. Martínez-Fonseca and Luis Gutiérrez-López.

This exotic species has previously been reported from the department by Salazar et al. (2009). It is a very common species which, although frequently absent from well-forested areas, is widely distributed throughout the department, particularly in the vicinity of artificial lights in urban areas.

### Family Gymnophthalmidae

*Gymnophthalmus speciosus* (Hallowell, 1861): Figure 6A. Golden Spectacled Tegu; Chomba coliroja.

Southern portion of Jinotepe city (11.83746°N, 86.18894°W); elev. 521 m; 16 November 2011. José G. Martínez-Fonseca.

This species has previously been reported from the department by García-Roa and Sunyer (2012). Although this species is only known from 3 individuals in Carazo, it is locally abundant in forest patches with abundant leaf-litter in the lowlands of the department.



**Figure 6.** A) *Gymnophthalmus speciosus* from Jinotepe; B) *Ctenosaura quiquecarinata* from RVS Río Escalante-Chacocente; C) *Ctenosaura similis* from Tupilapa; D) *Iguana iguana* from RVS Río Escalante-Chacocente; E) *Marisora brachypoda* from Finca La Joya; F) *Sceloporus squamosus* from La Junta; G) *Sceloporus variabilis* from Finca La Joya; and H) *Phyllodactylus tuberculosus* from Finca El Manantial. Photographs A-C, E-H by J.G. Martínez-Fonseca; D by M. Salazar-Saavedra.

### Family Iguanidae

*Ctenosaura quinquecarinata* (Gray, 1842): Figure 6B. Five-keeled Spiny-tailed Iguana; Garrobo cola chata.

RVS Río Escalante-Chacocente ( $11.54174^{\circ}\text{N}$ ,  $86.19509^{\circ}\text{W}$ ); elev. 22 m; 10 January 2010. José G. Martínez-Fonseca.

The distribution range of these species has discontinuous populations in Nicaragua (Otero and Mendoza, 2011), some of which have previously been reported from the department by Otero (2003), Salazar et al. (2009), and Otero and Mendoza (2011). Its presence in the department of Carazo is restricted to well-protected dry forests, where it is a relatively common species. Local people erroneously think that this species is venomous both to humans and animals and kills it on sight.

*Ctenosaura similis* (Gray, 1831): Figure 6C. Common Spiny-tailed Iguana; Garrobo negro.

Near Tupilapa, Municipio de Jinotepe ( $11.60716^{\circ}\text{N}$ ,  $86.29425^{\circ}\text{W}$ ); elev. 16 m; 6 April 2007; José G. Martínez-Fonseca.

This species has previously been reported from the department by Köhler (2001) and Salazar el al. (2009). While it is a rather common species in the whole department, adults are enthusiastically hunted by humans as a source of food.

*Iguana iguana* (Linnaeus, 1758): Figure 6D. Common Green Iguana; Iguana verde.

RVS Río Escalante-Chacocente ( $11.53470^{\circ}\text{N}$ ,  $86.17181^{\circ}\text{W}$ ); elev. 50 m; 29 November 2013. Milton Salazar-Saavedra.

This species has previously been reported from the department by Salgado (2007) and Salazar el al. (2009). It is a relatively uncommon species in the department, confined mostly to well-preserved rivers and estuaries where adults are eagerly hunted as a source of food.

### Family Mabuyidae

*Marisora brachypoda* (Taylor, 1956): Figure 6E. Bronze-backed Mabuya; Chomba lucia.

Finca La Joya, Municipio de Santa Teresa ( $11.79772^{\circ}\text{N}$ ,  $86.14878^{\circ}\text{W}$ ); elev. 376 m; 3 July 2010; José G. Martínez-Fonseca.

This species has previously been reported from the department by Salazar el al. (2009). It is a rather common species in the department that can be particularly abundant in the leaf litter of transitional areas with forest patches and around streams and rivers.

### Family Phrynosomatidae

*Sceloporus squamosus* (Bocourt, 1874): Figure 6F. Dwarf Spiny Lizard; Pichete delgado.

Comunidad de La Junta, Municipio de Diriamba (11.76671°N, 86.41608°W); elev. 103 m; 4 January 2017. José G. Martínez-Fonseca and Luis E. Gutiérrez-López.

We photographed a juvenile individual (Figure 6F) while active at ground level on the side of a trail during daytime. New departmental record.

*Sceloporus variabilis* Wiegmann, 1834: Figure 6G. Rose-bellied Lizard; Pichete común.

Finca La Joya, Municipio de Santa Teresa (11.79772°N, 86.14878°W); elev. 376 m; 4 February 2010. José G. Martínez-Fonseca.

This species has previously been reported from the department by Köhler (2001) and Salazar et al. (2009). It is a very common species which is widely distributed throughout the department, particularly in its lowlands.

### Family Phyllodactylidae

*Phyllodactylus tuberculosus* (Wiegmann, 1834): Figure 6H. Tuberculated Leaf-toed Gecko; Gueco tuberculoso.

Finca El Manantial, Comunidad de Los Velázquez, Municipio de Diriamba (11.77112°N, 86.38182°W); elev. 92 m; 26 September 2010. José G. Martínez-Fonseca and Luis Gutiérrez-López.

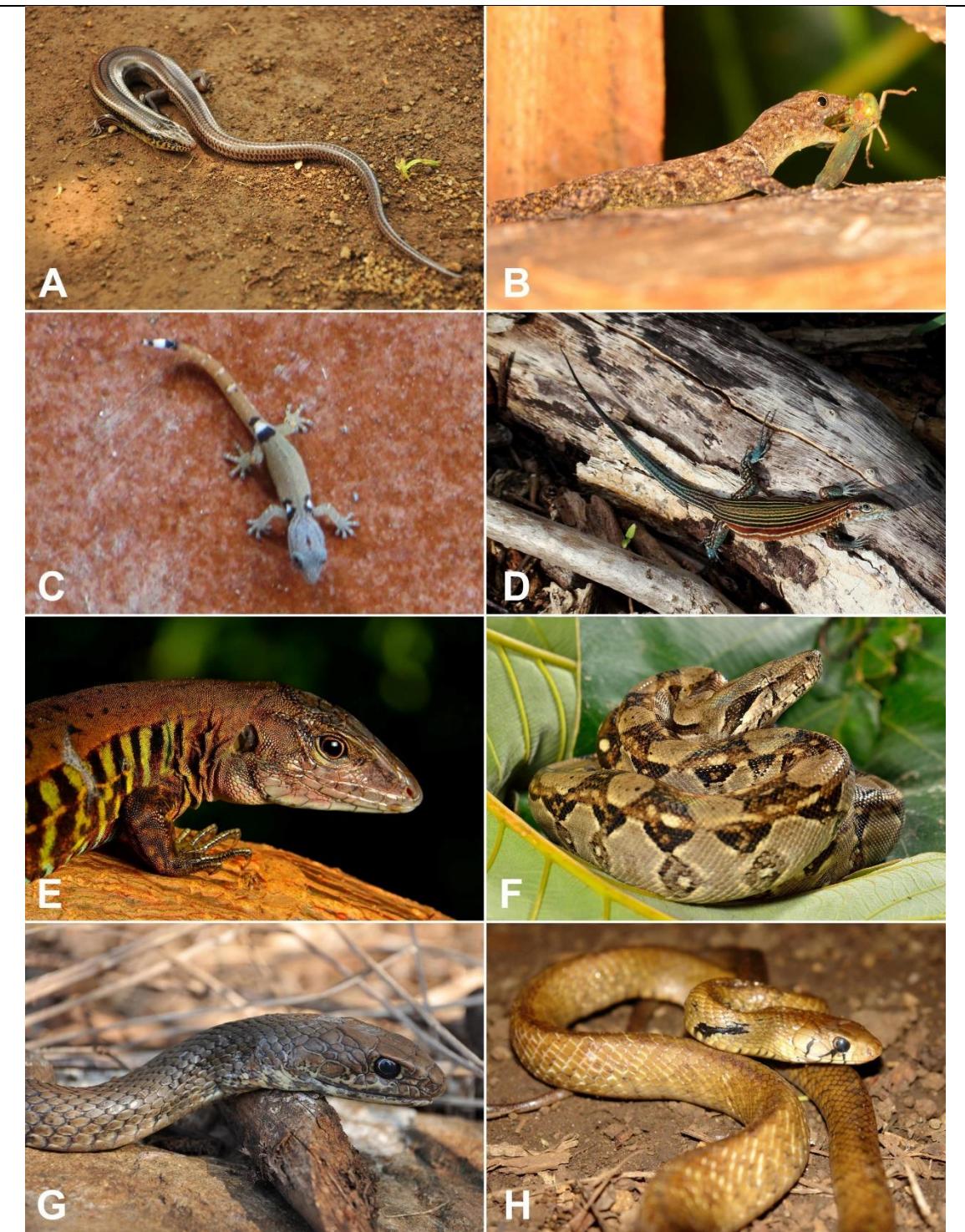
This species has previously been reported from the department by Salazar et al. (2009). It is a relatively uncommon species, and we have seen it displaced by the introduced *Hemidactylus frenatus* to forested areas with no electrical power.

### Family Scincidae

*Mesoscincus managuae* (Dunn, 1933): Figure 7A. Managua Skink; Chomba de Managua.

RVS Río Escalante-Chacocente (11.55843°N, 86.14829°W); elev. 20 m; 16 June 2009. Milton Salazar Saavedra and José G. Martínez-Fonseca.

This species has previously been reported from the department by Salazar et al. (2009) and HerpetoNica (2015). It is a relatively uncommon species known from forested habitats in the department.



**Figure 7.** A) *Mesoscincus managuae* from RVS Río Escalante-Chacocente; B) *Gonatodes albogularis* from Santa Teresa; C) *Sphaerodactylus millepunctatus* from San Marcos; D) *Aspidoscelis deppii* from RVS Río Escalante-Chacocente; E) *Holcosus undulatus* and F) *Boa imperator* from Finca La Joya; G) *Coluber mentovarius* from road Santa Teresa to La Solera; and H) *Drymarchon melanurus* from Santa Teresa. Photographs A-B, D-H by J.G. Martínez-Fonseca; C by E. van den Berghe.

### Family Sphaerodactylidae

*Gonatodes albogularis* (Duméril & Bibron, 1836): Figure 7B. Yellow-headed Gecko; Gueco cabeciamarillo.

Santa Teresa, Municipio de Santa Teresa (11.80328°N, 86.1644°W); elev. 406 m; 24 July 2011. José G. Martínez-FONSECA.

This species has previously been reported from the department by Salazar et al. (2009). It is a very common species throughout the department, including forested, altered, and urban habitats.

*Sphaerodactylus millepunctatus* (Hallowell, 1861): Figure 7C. Spotted Least Dwarf Gecko; Gueco punteado.

Municipio de San Marcos (11.90361°N, 86.18152°W); elev. 486 m; 10 November 2008. Eric van den Berghe.

A single individual (Figure 7C) was found during daytime on a wall in a shade coffee plantation. New departmental record and first Nicaraguan record of the species in LDF.

### Family Teiidae

*Aspidoscelis deppii* (Weigmann, 1834): Figure 7D. Blackbelly Racerunner; Corredora rayada.

RVS Río Escalante-Chacocente (11.53952°N, 86.19711°W); elev. 6 m; 23 November 2008. José G. Martínez-FONSECA.

This species has previously been reported from the department by Salazar et al. (2009). It is a very common species throughout the department, particularly in open habitats in the lowlands and surroundings of sandy beaches.

*Holcosus undulatus* (Wiegmann, 1834): Figure 7E. Rainbow Ameiva; Lagartija pintada.

Finca La Joya, Municipio de Santa Teresa (11.79709°N, 86.14737°W); elev. 369 m; 11 November 2011. José G. Martínez-FONSECA.

This species has previously been reported from the department by Köhler (2001) and Salazar et al. (2009). It is a rather common species throughout the department, particularly around forested habitats.

**Order Squamata - Snakes**

**Family Boidae**

*Boa imperator* (Daudin, 1803): Figure 7F. Common Boa; Boa.

Finca La Joya, Municipio de Santa Teresa (11.79774°N, 86.14880°W); elev. 380 m; 22 August 2012. José G. Martínez-Fonseca.

This species has previously been reported from the department by Köhler (2001) and Salazar et al. (2009). Although this species is feared and killed on sight by locals, it is relatively common in forested areas throughout the department.

**Family Colubridae**

*Coluber mentovarius* (Duméril, Bibron & Duméril, 1854): Figure 7G. Neotropical Whipsnake; Zumbadora.

Road from Santa Teresa to La Solera, Comunidad de Buena Vista (11.68339°N, 86.17732°W); elev. 262 m; 16 January 2010. José G. Martínez-Fonseca.

This species has previously been reported from the department by Salazar et al. (2009). Köhler (2001) additionally cites a specimen of this species from “Carazo: 82 km S Managua on Hwy 2: VW 212”. However, Carazo is much closer to Managua than 82 km and either there was a typing error in Köhler (2001), or this locality corresponds to somewhere between the departments of Granada and Rivas. It is a relatively common species in forested areas throughout the department.

*Drymarchon melanurus* (Duméril, Bibron & Duméril, 1854): Figure 7H. Central American Indigo Snake; Voladora Colinegra.

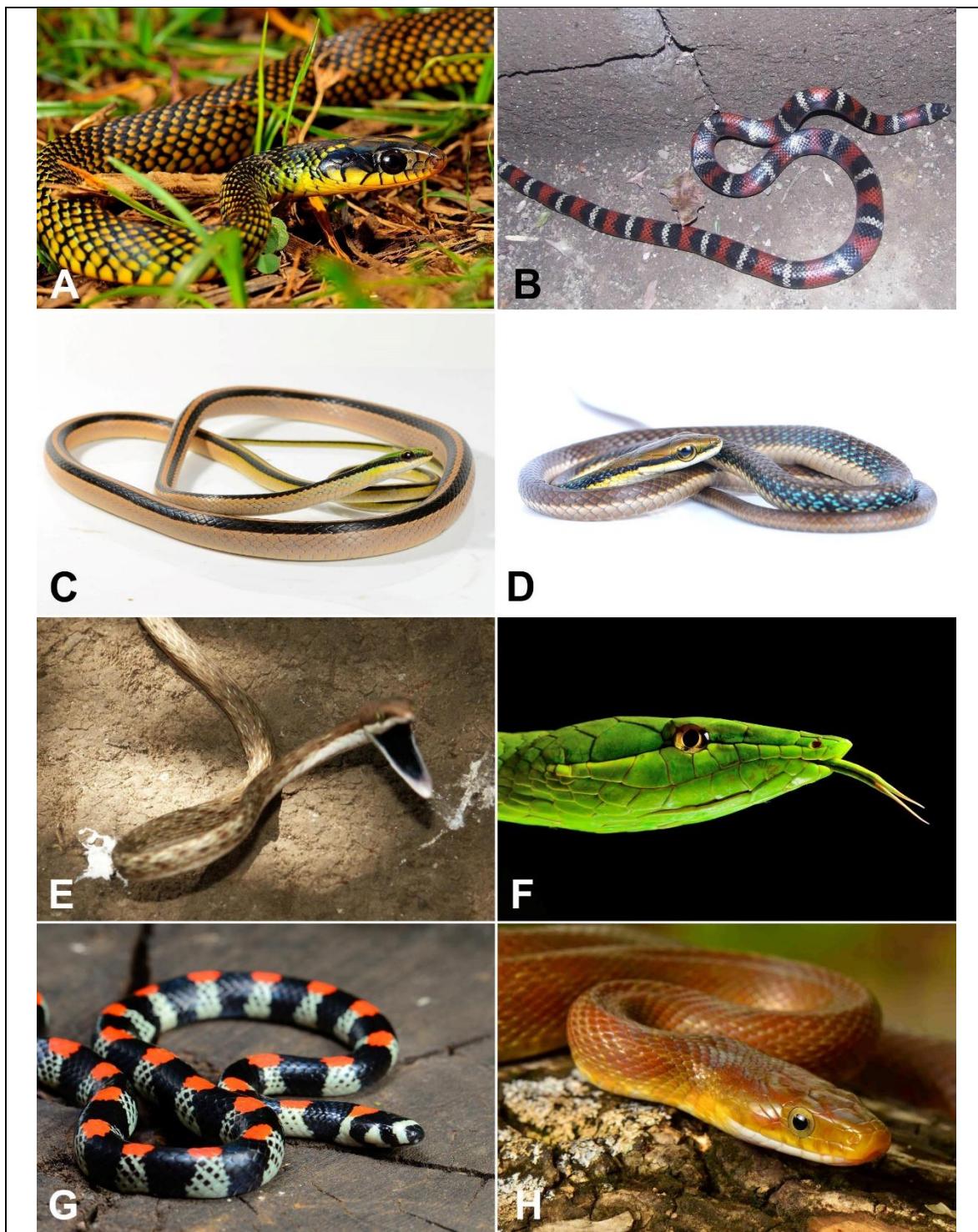
2 km South of Santa Teresa (11.77772°N, 86.15760°W); elev. 333 m; 3 December 2006. José G. Martínez-Fonseca.

This species has previously been reported from the department by Salazar et al. (2009). It is a rather common species in forested (and to a lesser degree in altered) habitats throughout the department.

*Drymobius margaritiferus* (Schlegel, 1837): Figure 8A. Central American Speckled Racer; Ranera salpicada.

Finca La Joya, Municipio de Santa Teresa (11.79721°N, 86.14743°W); elev. 370 m; 24 June 2012. José G. Martínez-Fonseca.

This species has previously been reported from the department by Salazar et al. (2009). It is a common species in forested areas throughout the department.



**Figure 8.** A) *Drymobius margaritiferus* from Finca La Joya; B) *Lampropeltis abnorma* from San Marcos; C) *Leptophis pulcherrimus* and D) *Leptophis mexicanus* from Finca La Joya; E) *Oxybelis aeneus* from San Marcos; F) *Oxybelis fulgidus* from RVS Río Escalante-Chacocente; G) *Sceloporus atrocinctus*; and H) *Senticolis triaspis* from San Gregorio. Photographs A, C-D, F-H by J.G. Martínez-Fonseca; B, E by E. van den Berghe.

*Lampropeltis abnorma* (Bocourt, 1886): Figure 8B. Guatemalan Milk Snake; Coral falso.

Municipio de San Marcos (11.90361°N, 86.18152°W); elev. 486 m; 19 September 2009. Eric van den Berghe.

This species has previously been reported from the department by Köhler (2001) and Salazar et al. (2009). It is a common species in forested areas throughout the department. A dark form has been reported from the highlands of the adjacent department of Masaya (Hertz et al. 2009).

*Leptodrymus pulcherrimus* (Cope, 1874): Figure 8C. Striped Lowland Snake; Bejuquilla rayada.

Finca La Joya, Municipio de Santa Teresa (11.79762°N, 86.14869°W); elev. 376 m; 13 June 2014. José G. Martínez-Fonseca.

This species has previously been reported from the department by Köhler (2001), Salazar et al. (2009), and HerpetoNica (2015). It is a common species in forested areas throughout the department.

*Leptophis mexicanus* (Duméril, Bibron & Duméril, 1854): Figure 8D. Mexican Parrot Snake; Chocoya bronceada.

Finca La Joya, Municipio de Santa Teresa (11.798014°N, 86.148184°W); elev. 375 m; 20 November 2014. José G. Martínez-Fonseca.

We found a juvenile of this species (Figure 8D) during daytime on a Pitahaya (*Hylocereus* sp.) field. New departmental record.

*Oxybelis aeneus* (Wagler, 1824): Figure 8E. Neotropical Brown Vine Snake; Bejuquilla café.

Municipio de San Marcos (11.90361°N, 86.18152°W); elev. 486 m; 3 March 2008. Eric van den Berghe.

This species has previously been reported from the department by Salazar et al. (2009). It is a relatively common species in forested and altered areas throughout the department.

*Oxybelis fulgidus* (Daudin, 1803): Figure 8F. Green Vine Snake; Bejuquilla mayor.

RVS Río Escalante-Chacocente, Municipio de Santa Teresa (11.547580°N, 86.154677°W); elev. 16 m; 31 January 2015. José G. Martínez-Fonseca.

We found an individual (Figure 8F) while it was crossing a dirt road at 1500 h. New departmental record.

***Scolecophis atrocinctus*** (Schlegel, 1837): Figure 8G. Harlequin Snake; Falso coral maculado.

Comunidad de San Gregorio, Municipio de Diriamba (11.83885°N, 86.30270°W); elev. 423 m; 29 November 2012. José G. Martínez-Fonseca and Luis E. Gutiérrez-López.

This species has previously been reported from the department by Salazar et al. (2009). This is a relatively uncommon species in the department and seems to be associated with well-preserved forest patches.

***Senticolis triaspis*** (Cope, 1866): Figure 8H. Green Rat Snake; Ratonera Tropical Común.

Comunidad de San Gregorio, Municipio de Diriamba (11.83931°N, 86.30242°W); elev. 419 m; 13 July 2011. José G. Martínez-Fonseca and Luis E. Gutiérrez-López.

We found an adult individual (Figure 8H) climbing a fence post at dusk. New departmental record.

***Spilotes pullatus*** (Linnaeus, 1758): Figure 9A. Yellow Rat Snake; Culebra mica.

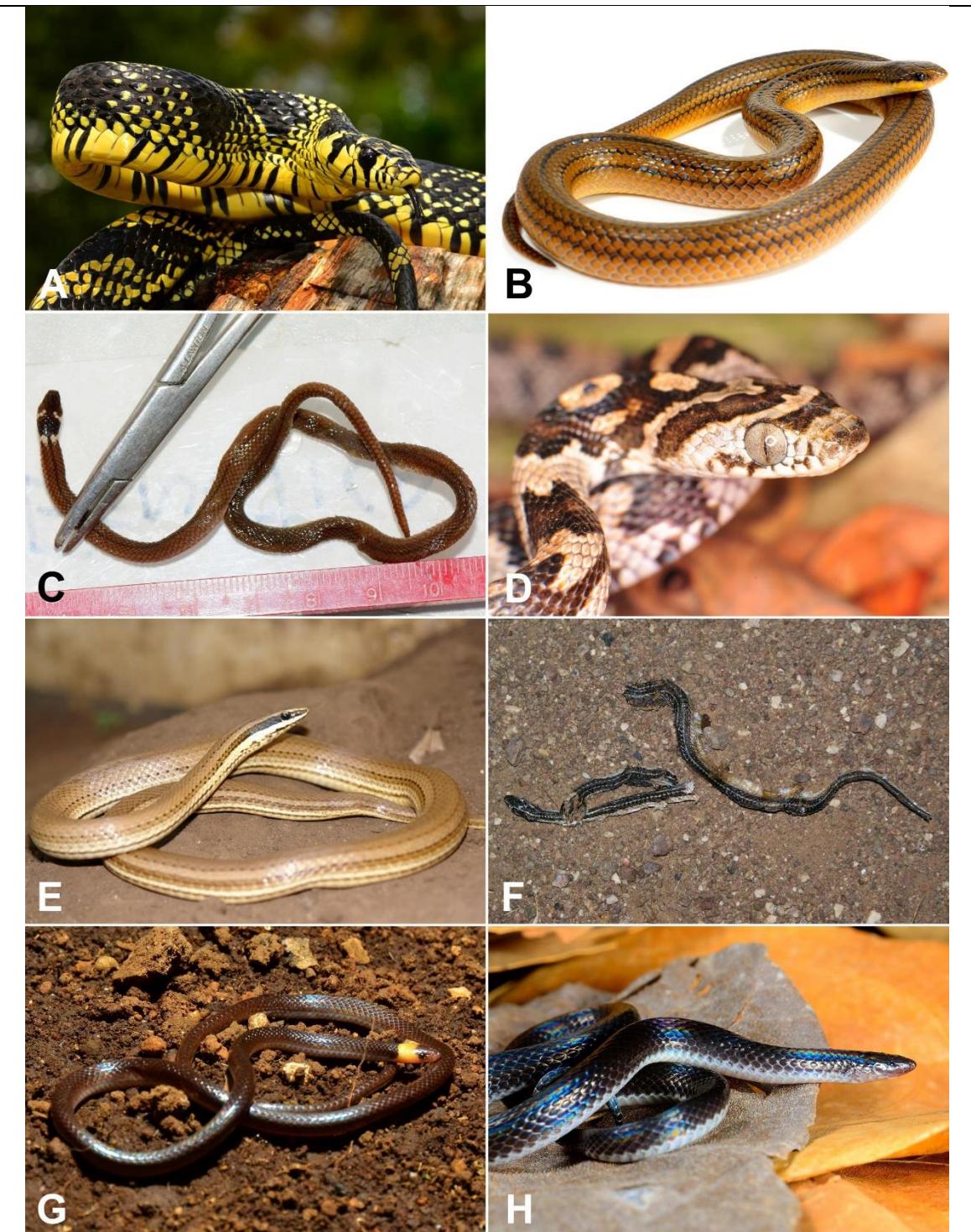
Comunidad de San Gregorio, Municipio de Diriamba (11.83953°N, 86.30400°W); elev. 414 m; 3 October 2011. José G. Martínez-Fonseca and Luis E. Gutiérrez-López.

This species has previously been reported from the department by Salazar et al. (2009). It is a relatively common species in the department and seems to be associated with well-preserved forest patches.

***Stenorhina freminvillii*** (Duméril, Bibron & Duméril, 1854): Figure 9B. Blood Snake; Víbora de sangre.

Comunidad de San Gregorio, Municipio de Diriamba (11.83991°N, 86.30437°W); elev. 412 m; 28 August 2013. José G. Martínez-Fonseca and Luis E. Gutiérrez-López.

This species has previously been reported from the department by Köhler (2001) and Salazar et al. (2009). It is a rather common species in the department, both in open and forested habitats.



**Figure 9.** A) *Spilotes pullatus*, B) *Stenorrhina freminvillii*, C) *Tantilla armillata*, and D) *Trimorphodon quadruplex* from San Gregorio; E) *Conophis lineatus* from Santa Teresa; F) road-killed *Crisantophis nevermanni* from San Marcos; G) *Enulius flavitorques* from Finca La Joya; and H) *Geophis hoffmanni* from Reserva Privada Refugio Bartola, department of Río San Juan. Photographs A-E, G-H by J.G. Martínez-Fonseca; F by M. Salazar-Saavedra.

***Tantilla armillata*** (Cope, 1875): Figure 9C. Black-headed Snake; Tragaciempiés cabecinegra.

Comunidad de San Gregorio, Municipio de Diriamba ( $11.83952^{\circ}\text{N}$ ,  $86.30356^{\circ}\text{W}$ ); elev. 417 m; 9 January 2013. José G. Martínez-Fonseca and Luis E. Gutiérrez-López.

This species has previously been reported from the department by HerpetoNica (2015). It is a relatively uncommon species in the department.

***Trimorphodon quadruplex*** (Smith, 1941): Figure 9D. Central American Lyre Snake; Zorcuata.

Comunidad de San Gregorio, Municipio de Diriamba ( $11.83983^{\circ}\text{N}$ ,  $86.30331^{\circ}\text{W}$ ); elev. 419 m; 24 April 2010. José G. Martínez-Fonseca and Luis E. Gutiérrez-López.

This species has previously been reported from the department by Köhler (2001) and Salazar et al. (2009). It is a relatively common species in the department.

### Family Dipsadidae

***Conophis lineatus*** (Duméril, Bibron & Duméril, 1854): Figure 9E. Road Guarder Snake; Guardacaminos.

2 km S Santa Teresa, Municipio Santa Teresa ( $11.78389^{\circ}\text{N}$ ,  $86.1572^{\circ}\text{W}$ ); elev. 347 m; 28 December 2006. José G. Martínez-Fonseca.

This species has previously been reported from the department by Salazar et al. (2009). It is a rather common species in the department, including forested and altered habitats as well as the proximities of urban areas.

***Crisantophis nevermanni*** (Dunn, 1937): Figure 9F. Dunn's Road Guarder; Ranera rayada.

Road from San Marcos to Masatepe ( $11.90978^{\circ}\text{N}$ ,  $86.18982^{\circ}\text{W}$ ); elev. 505 m; 3 August 2013. Milton Salazar-Saavedra.

We found an individual of this species (Figure 9F) which had been run over by a car. New departmental record.

***Enulius flavitorques*** (Cope, 1869): Figure 9G. Pacific Longtail Snake; Serpiente cola larga del Pacífico.

Finca La Joya, Municipio de Santa Teresa ( $11.798014^{\circ}\text{N}$ ,  $86.148184^{\circ}\text{W}$ ); elev. 375 m; 11 March 2011. José G. Martínez-Fonseca and Luis E. Gutiérrez-López.

This species has previously been reported from the department by Köhler (2001). It is a relatively uncommon species in the department.

***Geophis hoffmanni*** (Peters, 1859): Figure 9H. Hoffmann's Earth Snake; Minadora uniforme.

We haven't seen this species in Carazo but provide a photograph from the department of Río San Juan, southeastern Nicaragua (Figure 9H). Köhler (2001) reported this species from the department based on a single specimen collected in Jinotepe.

***Imantodes gemmistratus*** (Cope, 1862): Figure 10A. Central American Tree Snake; Cordelilla destenida.

Southern portion of the city of Jinotepe, Municipio de Jinotepe ( $11.83687^{\circ}$ N,  $86.18844^{\circ}$ W); elev. 519 m; 12 September 2014. José G. Martínez-Fonseca.

We found an individual (Figure 10A) during nighttime on a hedgerow near a stream. New departmental record.

***Leptodeira nigrofasciata*** (Günther, 1868): Figure 10B. Black-banded Cat-eyed Snake; Escombrera imitadora.

Santa Teresa city, Municipio de Santa Teresa ( $11.80267^{\circ}$ N,  $86.16171^{\circ}$ W); elev. 401 m; 14 June 2014. José G. Martínez-Fonseca.

This species has previously been reported from the department by Salazar et al. (2009). It is a rather common species in the department, including forested, altered, and urban habitats.

***Leptodeira rhombifera*** (Günther, 1872): Figure 10C. American Cat-eyed Snake; Escombrera común.

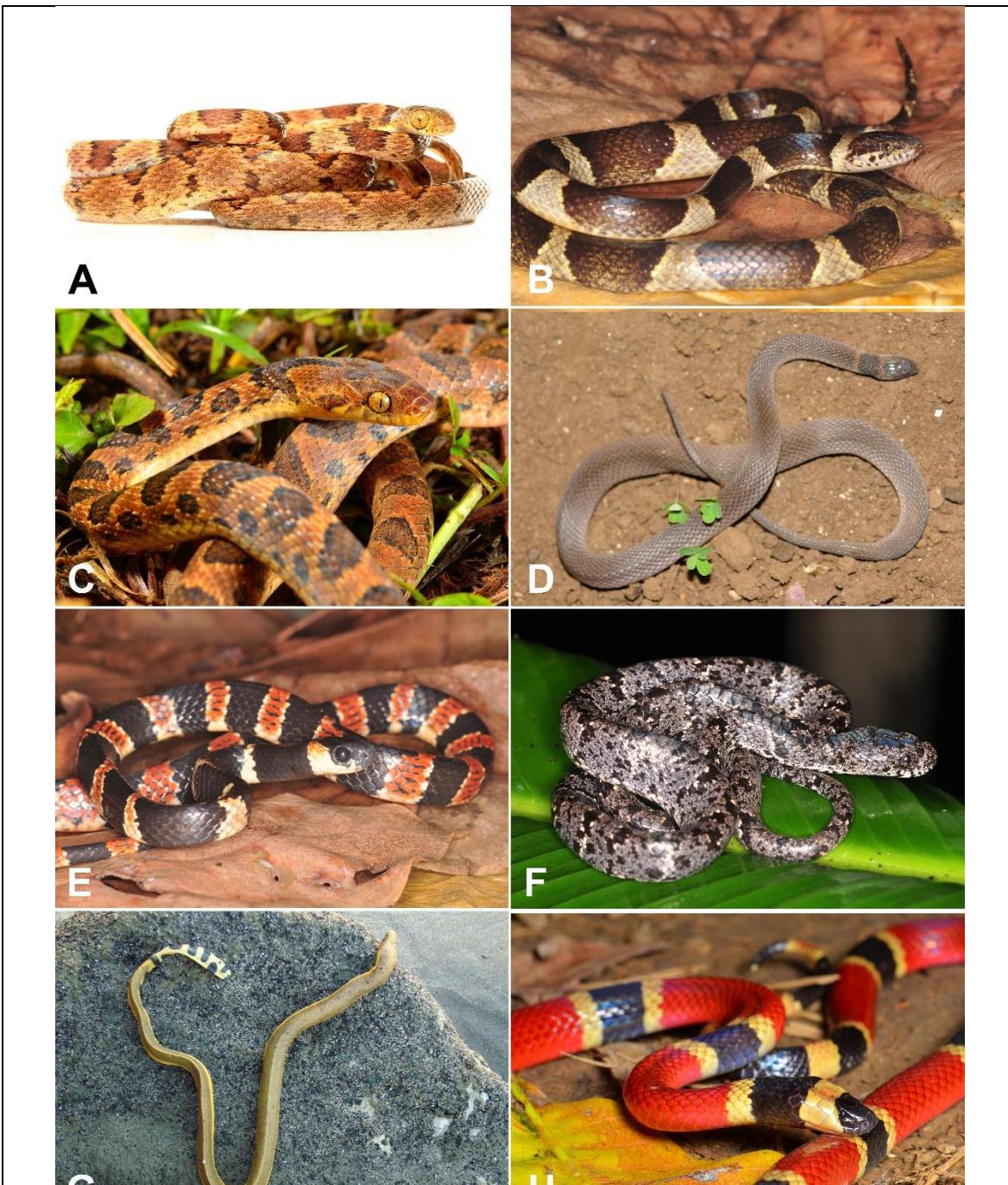
Santa Teresa ( $11.80233^{\circ}$ N,  $86.16653^{\circ}$ W); elev. 393 m; 1 July 2012. José G. Martínez-Fonseca.

This species has previously been reported from the department by Salazar et al. (2009). It is a rather common species in the department, including forested, altered, and urban habitats.

***Ninia sebae*** (Duméril, Bibron & Duméril, 1854): Figure 10D. Redback Coffee Snake; Gargantilla roja.

Finca La Joya, Municipio de Santa Teresa ( $11.79997^{\circ}$ N,  $86.14799^{\circ}$ W); elev. 379 m; 15 November 2006. José G. Martínez-Fonseca.

This species has previously been reported from the department by Köhler (2001) and Salazar et al. (2009). It is a relatively common species in forest patches with abundant leaf-litter as well as in shade coffee plantations in the department.



**Figure 10.** A) *Imantodes gemmistratus* from Jinotepe; B) *Leptodeira nigrofasciata* and C) *Leptodeira rhombifera* from Santa Teresa; D) *Ninia sebae* from Finca La Joya; E) *Sibon anthracops* from San Gregorio; F) *Sibon nebulatus* from RSP Finca Concepción de María; G) *Hydrophis platurus* from RVS Río Escalante-Chacocente; and H) *Micrurus nigrocinctus* from Finca La Joya. Photographs A-F, H by J.G. Martínez-Fonseca; G by A. Rivera.

*Sibon anthracops* (Cope, 1868): Figure 10E. Ringed Snail-eater Snake; Tragababosas impostora.

Comunidad de San Gregorio, Municipio de Diriamba ( $11.83925^{\circ}\text{N}$ ,  $86.30330^{\circ}\text{W}$ ); elev. 418 m; 13 June 2010. Luis E. Gutiérrez-López.

This species has previously been reported from the department by Köhler (2001) and Lotzkat et al. (2012). It is a relatively uncommon species known from forested habitats in the department.

*Sibon nebulatus* (Linnaeus, 1758): Figure 10F. Cloudy Snail-eater Snake; Tragababosas jaspeada.

RSP Finca Concepción de María, Municipio de Dolores ( $11.86138^{\circ}\text{N}$ ,  $86.21303^{\circ}\text{W}$ ); elev. 590 m; 29 June 2011. José G. Martínez-FONSECA and Milton Salazar Saavedra.

We photographed three individuals of this species (Figure 10F) at nighttime while active in a shade coffee plantation. New departmental record and first Nicaraguan record of the species in LDF.

#### Family Elapidae

*Hydrophis platurus* (Linnaeus, 1766): Figure 10G. Yellowbelly Sea Snake; Serpiente marina.

RVS Rio Escalante-Chacocente ( $11.52552^{\circ}\text{N}$ ,  $86.17725^{\circ}\text{W}$ ); elev. 0 m; 9 March 2009. Maynor A. Fernández and Alejandra Rivera.

This very same record has been previously reported by HerpetoNica (2015). This marine snake is rather uncommon in the department.

*Micruurus nigrocinctus* (Girard, 1855): Figure 10H. Central American Coral Snake; Coral.

Finca La Joya, Municipio de Santa Teresa ( $11.79950^{\circ}\text{N}$ ,  $86.14810^{\circ}\text{W}$ ); elev. 375 m; 25 January 2012. José G. Martínez-FONSECA.

This species has previously been reported from the department by Salazar et al. (2009). Although this species is feared and killed on sight, it is rather common throughout the department, including forested and altered habitats, as well as the peripheries of urban areas.

### Family Leptotyphlopidae

*Epictia ater* (Taylor, 1940): Figure 11A. Black Blind Snake; Culebrita de tierra común.

Finca La Joya en el Municipio de Santa Teresa (11.79774°N, 86.14841°W); elev. 376 m; 30 May 2007. José G. Martínez-Fonseca.

This species has previously been reported from the department by Köhler (2001). It is a relatively common species in forested, altered, and urban habitats in the department, although it is rarely seen.

### Family Loxocemidae

*Loxocemus bicolor* (Cope, 1861): Figure 11B. Mexican Burrowing Phyton; Ñatilla.

RSP La Máquina, Municipio de Diriamba (11.741736°N, 86.32749°W); elev. 107 m; 11 June 2009. Maynor A. Fernández.

Nelson and Meyer (1967) record a specimen of this species from Carazo (UF 471). However, the locality provided “Las Jinotepes, 11 km S Managua, UF 471”, likely corresponds to a southern neighborhood in the department of Managua called “Las Jinotepes”. The town Jinotepe, in the department of Carazo, is ca. 30 km straight line S from Managua. Therefore, our photograph almost certainly constitutes a new departmental record.

### Family Viperidae

*Crotalus simus* (Latreille, 1801): Figure 11C. Middle American Rattlesnake; Cascabel.

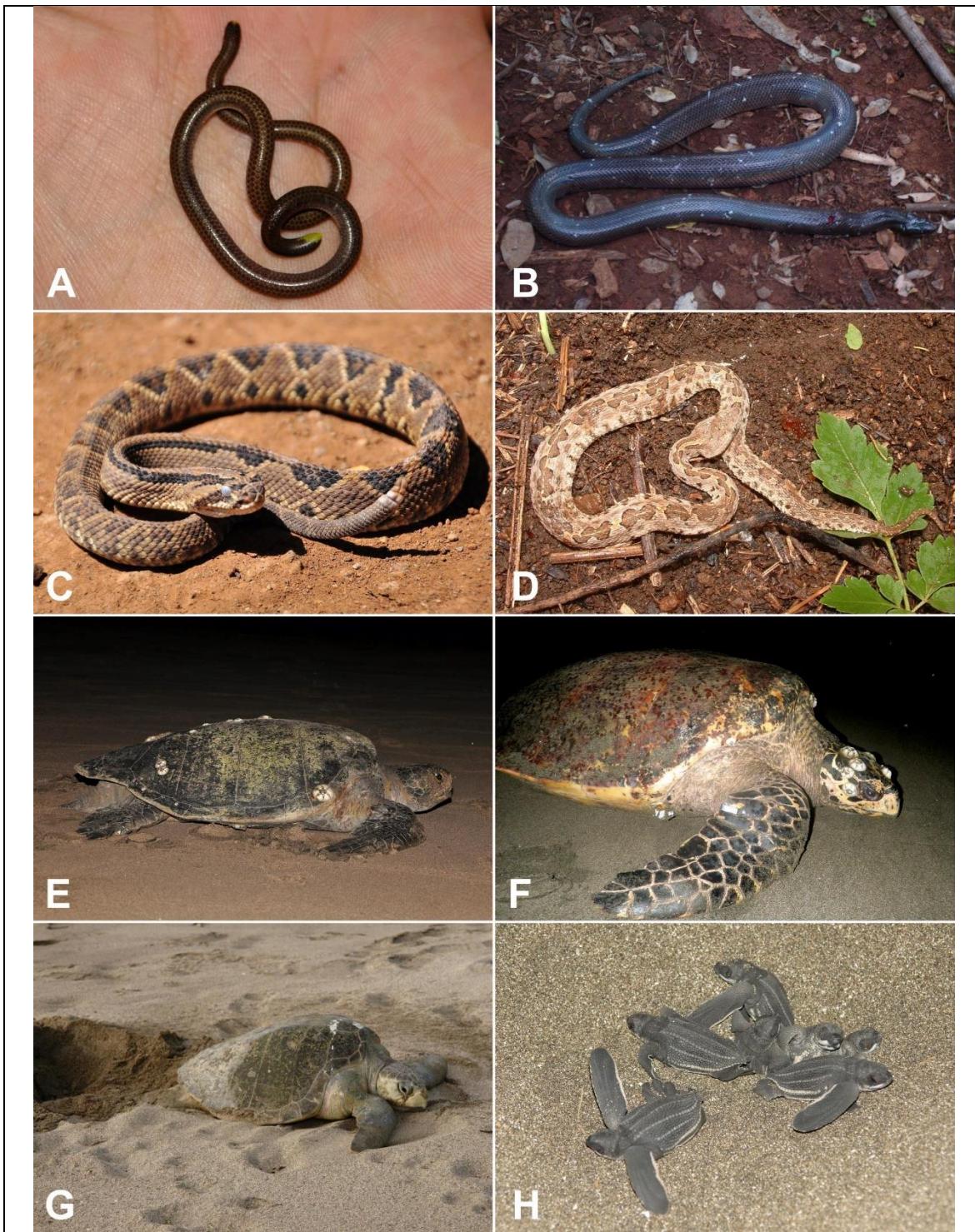
Comunidad de San Gregorio, Municipio de Diriamba (11.83963°N, 86.30359°W); elev. 417 m; 28 August 2009. Luis E. Gutiérrez-López.

This species has previously been reported from the department by Salazar et al. (2009). It is a greatly feared species, which is killed on sight. Therefore, it has become very uncommon outside the RVS Río Escalante-Chacocente protected area.

*Porthidium ophryomegas* (Bocourt, 1868): Figure 11D. Slender Hognose Pitviper; Corníz.

Municipio de San Marcos (11.90361°N, 86.18152°W); elev. 486 m; 5 May 2005. Eric van den Berghe.

This species has previously been reported from the department by Köhler (2001). It is an uncommon species known from forested habitats in the department.



**Figure 11.** A) *Epictia ater* from Finca La Joya; B) *Loxocemus bicolor* from RSP Finca La Máquina; C) *Crotalus simus* from San Gregorio; D) *Porthidium ophryomegas* from San Marcos; E) *Chelonia mydas*, F) *Eretmochelys imbricata*, G) *Lepidochelys olivacea*; and H) juveniles *Dermochelys coriacea* from RVS Río Escalante-Chacocente. Photographs A, C, E-G by J.G. Martínez-Fonseca; B by M.A. Fernández; D by E. van den Berghe; F by E. Altamirano.

**Order Testudines**

**Family Cheloniidae**

*Chelonia mydas* (Linnaeus, 1758): Figure 11E. Green Sea Turtle; Tortuga torita.

RVS Río Escalante-Chacocente (11.53512°N, 86.18861°W); elev. 0 m; 14 November 2009. José G. Martínez-Fonseca, Luis Gutiérrez-López, and Marlon Chávez-Velásquez.

This marine species has previously been reported from the department by MARENA (2007) and Salazar et al. (2009). The nestings of this endangered species in the RVS Río Escalante-Chacocente, although relatively uncommon, were one of the principal justifications for the creation of this protected area in 1983 (MARENA 2007).

*Eretmochelys imbricata* (Linnaeus, 1766): Figure 11F. Hawksbill Sea Turtle; Tortuga carey.

We haven't seen this species in the department ourselves but provide a photograph from a Carazo locality (Figure 11F). Urteaga and Díaz (2007) and López and Blackwell (2009) record this critically endangered marine species from the department. The nestings of this species in the RVS Río Escalante-Chacocente, although solitary and uncommon (Gaos et al. 2010), were one of the principal justifications for the creation of this protected area in 1983 (MARENA 2007).

*Lepidochelys olivacea* (Eschscholz, 1829): Figure 11G. Olive Ridley Sea Turtle; Tortuga paslama.

RVS Río Escalante-Chacocente, playa Veracruz, near Mogote (11.53873°N, 86.19413°W); elev. 0 m; 11 November 2006. José G. Martínez-Fonseca.

The RVS Río Escalante-Chacocente is internationally known for the “arribadas” of this vulnerable marine turtle species, and research on this species here has received close attention (e.g., Vaughan et al. 2000; Gonzales 2001; Urteaga 2002, 2003; Honarvar 2007; MARENA 2007; Salazar et al. 2009; Duran et al. 2015; HerpetoNicas 2015). The “arribadas” of this species in the RVS Río Escalante-Chacocente constitute one of the most impressive natural spectacles in the entire country and were another principal justification for the creation of this protected area in 1983 (MARENA 2007).

### Family Dermochelyidae

*Dermochelys coriacea* (Vandelli, 1761): Figure 11H. Leatherback Sea Turtle; Tortuga tora.

RVS Río Escalante-Chacocente, playa Chacocente, tramo 3 ( $11.56638^{\circ}\text{N}$ ,  $86.23531^{\circ}\text{W}$ ); elev. 0 m; 3 March 2007. José G. Martínez-Fonseca.

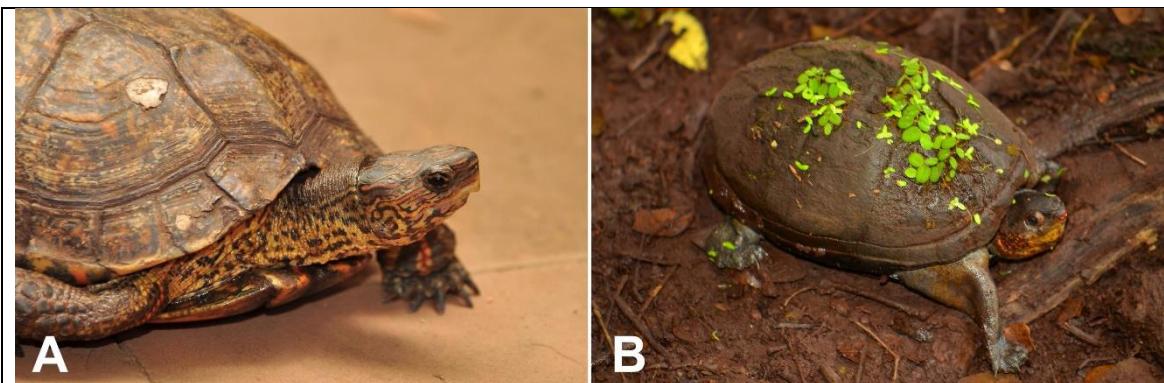
Nesting records of this vulnerable marine turtle species in the RVS Río Escalante-Chacocente are well documented (e.g., Morales 1983; Gonzales 2001; Araúz 2002; MARENA 2007; Torres 2009; Salazar et al. 2009) and were one of the main justifications for the creation of this protected area in 1983 (MARENA 2007).

### Family Geoemydidae

*Rhinoclemmys pulcherrima* (Gray, 1856): Figure 12A. Ornate Terrapin; Tortuga pintada.

Comunidad La Hormiga, Municipio de La Conquista ( $11.67734^{\circ}\text{N}$ ,  $86.17621^{\circ}\text{W}$ ); elev. 273 m; 19 June 2009. José G. Martínez-Fonseca.

This species, evaluated as Near Threatened at the global level by Sunyer and Köhler (2010), has previously been reported from the department by Vences et al. (1998) and Salazar et al. (2009). It is a relatively common species along streams and rivers in the department.



**Figure 12.** A) *Rhinoclemmys pulcherrima* from La Hormiga; and B) *Kinosternon alboguttatum* from Santa Teresa. Photographs by J.G. Martínez-Fonseca.

### Family Kinosternidae

*Kinosternon alboguttare* (Linnaeus, 1766): Figure 12B. White-throated Mud Turtle; Tortuga pecho quebrado.

Santa Teresa (11.79729°N, 86.16595°W); elev. 376 m; 1 July 2011. José G. Martínez-Fonseca.

This species has previously been reported from the department by Salazar et al. (2009). It is a relatively common species along moderately well-preserved streams, rivers, and large ponds in the department.

## DISCUSSION

The composition of the herpetofauna reported herein for Carazo is typical for the herpetofauna found along Nicaragua's Pacific lowlands, which is characterized by being relatively homogeneous (Sunyer and Köhler 2010). Sunyer and Köhler (2010) reported 87 terrestrial species from the LDF and PDF formations in Nicaragua: 20 amphibians and 67 reptiles. Out of these 87 species, 12 are relatively unlikely to occur in Carazo either given their known distributions (Köhler 2001, 2008, 2011) or because they are associated to permanent freshwater bodies (such as the Nicaraguan Great Lakes), which are absent in the department of Carazo. These 12 species are: *Incilius valliceps*, *Lithobates vaillanti*, *Bolitoglossa striatula*, *Caiman crocodilus*, *Celestus bivittatus*, *Basiliscus basiliscus*, *Pseudelaphe flavirufa*, *Tretanorhinus nigroluteus*, *Thamnophis marcianus*, *Thamnophis proximus*, *Trachemys emolli*, and *Kinosternon leucostomum*. Four additional species (*Lithobates warszewitschii*, *Chironius grandisquamis*, *Leptophis ahaetulla*, and *Bothrops asper*) have recently been recorded from transitional LDF in southwestern Nicaragua (Sunyer et al. 2014a, 2014b; López-Guevara et al. 2015; Martínez-Fonseca et al. 2015, 2016), but are also unlikely to occur in the department of Carazo given their known global distributions and ecological preferences.

The other way round, our list includes two species known from LDF and PDF that were not listed for Nicaragua's Pacific lowlands by Sunyer and Köhler (2010) but have been subsequently reported from these forest formations: *Norops pentaprion* was reported by Köhler (2010) from Reserva Natural Volcán Mombacho, department of Granada, and from Reserva de la Biosfera Isla Ometepe, department of Rivas; and *Norops quaggulus* was recorded by Phillips et al. (2015) from Reserva Natural Volcán Mombacho, RVS Río Escalante-Chacocente, and Reserva Natural Volcán San Cristóbal-Casita, department of Chinandega. Finally, there are five marine species in the Pacific waters of Nicaragua: *Chelonia mydas*, *Eretmochelys imbricata*, *Lepidochelys olivacea*, *Dermochelys coriacea*, and *Hydrophis platurus*.

This totals 82 potential species of amphibians (17) and reptiles (65) in the department of Carazo, which represents roughly one third (32%) of the known herpetofauna of Nicaragua (Salazar-Saavedra et al. 2015, 2018; Fernández et al. 2017; Loza et al. 2017; McCranie 2017; Gutiérrez-Rodríguez and Sunyer 2016; Phillips et al. 2015; Villa 2015; Sunyer 2014), without including other potentially introduced species such as *Hemidactylus spp.*, *Indotyphlops braminus*, etc.

Out of these 82 potential species of amphibians and reptiles that may occur in the department of Carazo, we here record 74 species (17 amphibians and 57 reptiles). Therefore, the following eight reptile species could potentially be found in the department and should be watched for: 1) *Crocodylus acutus*; 2) *Basiliscus vittatus*; 3) *Mastigodryas alternatus*; 4) *Tantilla vermiciformis*; 5) *Clelia clelia*; 6) *Coniophanes piceivittis*; 7) *Tropidodipsas sartorii*; and 8) *Akgistrodon howardgloydii*. Two of these species (*T. vermiciformis* and *A. howardgloydii*) have a distribution restricted to LDF in Nicaragua (Sunyer and Köhler 2010). *Clelia clelia* has been reported from the department of Carazo by Salgado (2007), Salazar et al. (2009), and has been visually verified by E. van den Berghe. However, we refrain from formally listing this species as a member of the department of Carazo until verifiable material is provided.

*Smilisca phaeota*, *Leptophis ahaetulla*, *Ninia maculata*, and *Rhadinea decorata* have been reported from the RVS Río Escalante-Chacocente in the department of Carazo by Salazar et al. (2009) based on Salgado (2007). Salgado (2007) additionally reported *Pristimantis cerasinus* and *Diasporus diastema* from the RVS Río Escalante-Chacocente. However, contrary to what was stated in Salgado (2007), all these species lack museum vouchers or photographs to justify their inclusion in this departmental checklist. Given their respective known distributions, which fall far away from the department of Carazo, we prefer not to include any of these species as members of the herpetofaunal community of Carazo until verifiable material is provided.

Out of the 74 species here recorded for the department of Carazo, seven species have been assigned one of the Threatened categories under the IUCN (2018; International Union for Conservation of Nature and Natural Resources) categorization: two amphibian species, *Craugastor laevissimus* (EN; A2ace) and *Dermophis mexicanus* (VU; A2ac); one lizard species, *Ctenosaura quinquecarinata* [EN; B1ab(iii,v)+2ab(iii,v)], and all four marine turtle species, *Lepidochelys olivacea* (VU; A2bd), *Dermochelys coriacea* (VU; A2bd), *Chelonia mydas* (EN; A2bd), and *Eretmochelys imbricata* (CR; A2bd). Over one fifth (21%) of the reptile species from the department are not yet rated under the IUCN categories (see Table 1; IUCN 2018). Sunyer and Köhler (2010) assessed these Nicaraguan species following the IUCN criteria and considered *Rhinoclemmys pulcherrima* a Near Threatened (NT) species and all other species from the department of Carazo that are not yet gauged as Least Concern (LC).

Sunyer and Köhler (2010) additionally provided each terrestrial species with an Environmental Vulnerability Score (EVS). The EVS is a value that can indicate the potential vulnerability of each species within the country to population decline and is calculated with the use of three components: 1) the extent of geographical range; 2) the extent of ecological distribution in Nicaragua; and 3) the degree of specialization of reproductive mode for amphibians and the degree of human persecution for reptiles (Wilson and McCranie 2003). At a Nicaraguan level, and out of the 69 terrestrial herpetofaunal species recorded for the department of Carazo (i.e., not including the 5 marine species), five are considered High Vulnerability (one amphibian and four reptiles species), 34 Medium Vulnerability (four amphibian and 30 reptile species), and 30 Low Vulnerability (12 amphibian and 18 reptile species; Table 1).

Most recently, Robleto et al. (2017) and Tórrez Gutiérrez et al. (2018) published the Nicaraguan Red List, for which they determined the threat category of the herpetofauna of Nicaragua at a national level with the use of six components: 1) the extent of geographical range; 2) the extent of ecological distribution in Nicaragua; 3) habitat status; 4) anthropogenic impact; 5) species resistance to habitat change; and 6) a criterion for category adjustment based on the authors' herpetological experience within the country. The Nicaraguan Red List included seven Threatened species present in the department of Carazo (Table 1; Robleto et al. 2017 and Tórrez Gutiérrez et al. 2018): two Critically Endangered (*Dermochelys coriacea* and *Eretmochelys imbricata*), one Endangered (*Chelonia mydas*), and four Vulnerable species (*Craugastor laevissimus*, *Dermophis mexicanus*, *Ctenosaura quinquecarinata*, and *Lepidochelys olivacea*), as well as five species assessed as Near Threatened (*Agalychnis callidryas*, *Sibon anthracops*, *S. nebulatus*, *Porthidium ophryomegas*, and *Rhinoclemmys pulcherrima*). Additionally, Robleto et al. (2017) remark that three species that occur in the department of Carazo have a category trend (Table 1): *Coleonyx mitratus* and *Iguana iguana*, assessed as Least Concern with a current trend to Near Threatened; and *Craugastor laevissimus*, assessed as Vulnerable with a current trend to Endangered.

At a Nicaraguan level, eleven species have some level of national protection with bans on hunting and trade in Nicaragua (La Gaceta 2013; Table 1): six are banned during their respective breeding season (*Agalychnis callidryas*, *Ctenosaura similis*, *Iguana iguana*, *Boa imperator*, *Lampropeltis abnorma*, and *Rhinoclemmys pulcherrima*); and five are indefinitely banned throughout the whole year (*Ctenosaura quinquecarinata*, *Chelonia mydas*, *Eretmochelys imbricata*, *Lepidochelys olivacea*, and *Dermochelys coriacea*).

Finally, four species (all four turtle marine species; i.e., *Chelonia mydas*, *Eretmochelys imbricata*, *Lepidochelys olivacea*, and *Dermochelys coriacea*) are included in the appendix I of CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora; CITES 2016) and four additional species (*Agalychnis callidryas*, *Iguana iguana*, *Boa imperator*, and *Loxocemus bicolor*) in CITES' appendix II (Table 1).

**Table 1.** Checklist and Threat categorization of the 74 species of amphibians and reptiles recorded from the department of Carazo. The table is ordered alphabetically by: class, order, family, genus, and species. Abbreviations and references used are: IUCN (International Union for Conservation of Nature and Natural Resources) categorization (IUCN 2018); EVS (Environmental Vulnerability Score; Sunyer and Köhler 2010); NRL (Nicaraguan Red List) categorization (Robleto et al. 2017; Tórrez Gutiérrez et al. 2018); NP (National Protection; La Gaceta 2013); and CITES appendices (Convention on International Trade in Endangered Species of Wild Fauna and Flora; CITES 2016). CR: Critically Endangered; EN: Endangered; VU: Vulnerable; NT: Near Threatened; and LC: Least Concern.

\* with a trend to NT; and \*\* with a trend to EN.

Taxa	IUCN	EVS	NRL	NP	CITES
<b>Class Amphibia</b>					
<b>Order Anura</b>					
<b>Family Bufonidae</b>					
<i>Incilius coccifer</i>	LC	Low	LC	-	-
<i>I. luetkenii</i>	LC	Low	LC	-	-
<i>Rhinella horribilis</i>	LC	Low	LC	-	-
<b>Family Craugastoridae</b>					
<i>Craugastor fitzingeri</i>	LC	Medium	LC	-	-
<i>C. laevissimus</i>	EN	Medium	VU**	-	-
<b>Family Hylidae</b>					
<i>Agalychnis callidryas</i>	LC	Low	NT	Partial	Appendix II
<i>Dendropsophus microcephalus</i>	LC	Low	LC	-	-
<i>Scinax staufferi</i>	LC	Low	LC	-	-

Taxa	IUCN	EVS	NRL	NP	CITES
<i>Smilisca baudinii</i>	LC	Low	LC	-	-
<i>Trachycephalus typhonius</i>	LC	Medium	LC	-	-
<b>Family Leptodactylidae</b>					
<i>Engystomops pustulosus</i>	LC	Low	LC	-	-
<i>Leptodactylus fragilis</i>	LC	Low	LC	-	-
<i>L. melanotus</i>	LC	Low	LC	-	-
<b>Family Microhylidae</b>					
<i>Hypopachus variolosus</i>	LC	Low	LC	-	-
<b>Family Ranidae</b>					
<i>Lithobates forreri</i>	LC	Low	LC	-	-
<b>Family Rhinophryidae</b>					
<i>Rhinophryne dorsalis</i>	LC	Medium	LC	-	-
<b>Order Gymnophiona</b>					
<b>Family Dermophiidae</b>					
<i>Dermophis mexicanus</i>	VU	High	VU	-	-
<b>Class Reptilia</b>					
<b>Order Squamata: Lizards</b>					
<b>Family Dactyloidae</b>					
<i>Norops biporcatus</i>	-	Low	LC	-	-

Taxa	UICN	EVS	NRL	NP	CITES
<i>N. cupreus</i>	-	Medium	LC	-	-
<i>N. pentaprion</i>	-	Medium	LC	-	-
<i>N. quaggulus</i>	-	Medium	LC	-	-
<i>N. unilobatus</i>	-	Low	LC	-	-
<b>Family Eublepharidae</b>					
<i>Coleonyx mitratus</i>	LC	Medium	LC*	-	-
<b>Family Gekkonidae</b>					
<i>Hemidactylus frenatus</i>	LC	Low	LC	-	-
<b>Family Gymnophthalmidae</b>					
<i>Gymnophthalmus speciosus</i>	LC	Low	LC	-	-
<b>Family Iguanidae</b>					
<i>Ctenosaura quinquecarinata</i>	EN	High	VU	Indefinite	-
<i>C. similis</i>	LC	Medium	LC	Partial	-
<i>Iguana iguana</i>	LC	High	LC*	Partial	Appendix II
<b>Family Mabuyidae</b>					
<i>Marisoraa brachypoda</i>	LC	Low	LC	-	-
<b>Family Phrynosomatidae</b>					
<i>Sceloporus squamosus</i>	LC	Medium	LC	-	-
<i>S. variabilis</i>	LC	Low	LC	-	-

Taxa	UICN	EVS	NRL	NP	CITES
<b>Family Phyllodactylidae</b>					
<i>Phyllodactylus tuberculosus</i>	LC	Low	LC	-	-
<b>Family Scincidae</b>					
<i>Mesoscincus managuae</i>	LC	High	LC	-	-
<b>Family Sphaerodactylidae</b>					
<i>Gonatodes albogularis</i>	LC	Low	LC	-	-
<i>Sphaerodactylus millepunctatus</i>	LC	Medium	LC	-	-
<b>Family Teiidae</b>					
<i>Aspidoscelis deppii</i>	LC	Medium	LC	-	-
<i>Holcosus undulatus</i>	LC	Low	LC	-	-
<b>Order Squamata: Snakes</b>					
<b>Family Boidae</b>					
<i>Boa imperator</i>	LC	Medium	LC	Partial	Appendix II
<b>Family Colubridae</b>					
<i>Coluber mentovarius</i>	LC	Medium	LC	-	-
<i>Drymarchon melanurus</i>	LC	Low	LC	-	-
<i>Drymobius margaritiferus</i>	LC	Medium	LC	-	-
<i>Lampropeltis abnorma</i>	-	Medium	LC	Partial	-
<i>Leptodeiramus pulcherrimus</i>	LC	Medium	LC	-	-

Taxa	UICN	EVS	NRL	NP	CITES
<i>Leptophis mexicanus</i>	LC	Medium	LC	-	-
<i>Oxybelis aeneus</i>	-	Low	LC	-	-
<i>O. fulgidus</i>	-	Low	LC	-	-
<i>Scolecophis atrocinctus</i>	LC	Medium	LC	-	-
<i>Senticolis triaspis</i>	LC	Medium	LC	-	-
<i>Spilotes pullatus</i>	-	Low	LC	-	-
<i>Stenorhina freminvillii</i>	LC	Medium	LC	-	-
<i>Tantilla armillata</i>	LC	Medium	LC	-	-
<i>Trimorphodon quadruplex</i>	LC	Medium	LC	-	-
<b>Family Dipsadidae</b>					
<i>Conophis lineatus</i>	LC	Medium	LC	-	-
<i>Crisantophis nevermanni</i>	LC	Medium	LC	-	-
<i>Enulius flavitorques</i>	LC	Medium	LC	-	-
<i>Geophis hoffmanni</i>	LC	Medium	LC	-	-
<i>Imantodes gemmistratus</i>	LC	Low	LC	-	-
<i>Leptodeira nigrofasciata</i>	LC	Medium	LC	-	-
<i>L. rhombifera</i>	LC	Medium	LC	-	-
<i>Ninia sebae</i>	LC	Low	LC	-	-
<i>Sibon anthracops</i>	LC	Medium	NT	-	-

Taxa	UICN	EVS	NRL	NP	CITES
<i>S. nebulatus</i>	-	Low	NT	-	-
<b>Family Elapidae</b>					
<i>Hydrophis platurus</i>	LC	-	LC	-	-
<i>Micrurus nigrocinctus</i>	LC	Low	LC	-	-
<b>Family Leptotyphlopidae</b>					
<i>Epictia ater</i>	LC	Low	LC	-	-
<b>Family Loxocemidae</b>					
<i>Loxocemus bicolor</i>	LC	Medium	LC	-	Appendix II
<b>Family Viperidae</b>					
<i>Crotalus simus</i>	LC	Medium	LC	-	-
<i>Porthidium ophryomegas</i>	LC	High	NT	-	-
<b>Order Testudines</b>					
<b>Family Cheloniidae</b>					
<i>Chelonia mydas</i>	EN	-	EN	Indefinite	Appendix I
<i>Eretmochelys imbricata</i>	CR	-	CR	Indefinite	Appendix I
<i>Lepidochelys olivacea</i>	VU	-	VU	Indefinite	Appendix I
<b>Family Dermochelyidae</b>					
<i>Dermochelys coriacea</i>	VU	-	CR	Indefinite	Appendix I
<b>Family Geoemydidae</b>					

Taxa	IUCN	EVS	NRL	NP	CITES
<i>Rhinoclemmys pulcherrima</i>	-	Medium	NT	Partial	-
<b>Family Kinosternidae</b>					
<i>Kinosternon albogulare</i>	-	Medium	LC	-	-

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