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Foto de Portada: *Agalychnis callidryas:* El Crucero, Managua, Nicaragua (Foto J. G. Martínez-Fonseca).

Comments and updates to "Guía Ilustrada de Anfibios y Reptiles de Nicaragua" along with taxonomic and related suggestions associated with the herpetofauna of Nicaragua

James R. McCranie[1], Javier Sunyer[2,3], and José G. Martínez Fonseca[2,3,4]

ABSTRACT

We comment on several geographic distribution statements and some taxonomic statements occurring in a recently published illustrated guide to the herpetofauna of Nicaragua. We also update the taxonomy of several species that have been published since work on that book was finished. In addition, we suggest resurrecting an available name for the northern populations of the *Agalychnis callidryas* species complex based on data not previously available, also make a documented and necessary type locality restriction for the toad *Rhinella horribilis*, and resurrect the genus *Enuliophis* from the synonymy of *Enulius*, where it was recently placed. Authors of some recent literature covering species that occur in Nicaragua have made some taxonomic decisions for which we also comment on. Finally, we add a list of species not currently known from Nicaragua, but seem likely to occur somewhere in that country.

KEY WORDS: amphibians, Central American species, geographical distributions, reptiles, taxonomic suggestions

[1]10770 SW 164 Street, Miami, Florida 33157, United States. E-mail: jmccrani@bellsouth.net (Corresponding author)
[2]Universidad Nacional Autónoma de Nicaragua (UNAN), Nicaragua
[3]Grupo HerpetoNica (Herpetólogos de Nicaragua), Nicaragua
[4]Northern Arizona University, 2101 N San Francisco St, Flagstaff, AZ 86001, United States

RESUMEN

Realizamos algunos comentarios en lo que respecta a la distribución geográfica y la taxonomía que aparece en la recientemente publicada Guía Ilustrada de Anfibios y Reptiles de Nicaragua. Además, actualizamos la taxonomía de varias especies que han sido publicadas desde la culminación de ese libro. Adicionalmente sugerimos resucitar un nombre disponible para las poblaciones más norteñas del complejo de especies de *Agalychnis callidryas* basados en datos no disponibles anteriormente, además de hacer una necesaria y documentada restricción de la localidad tipo del sapo *Rhinella horribilis*, y resucitar el género *Enuliophis* de la sinonimia de *Enulius*, donde ha sido ubicada recientemente. En publicaciones recientes, determinados autores que incluyen especies que ocurren en Nicaragua han tomado algunas decisiones taxonómicas sobre las cuales realizamos comentarios. Finalmente, agregamos una lista de especies que actualmente no se conocen de Nicaragua, pero que creemos puedan ocurrir en algún lugar del país.

PALABRAS CLAVES: anfibios, distribución geográfica, especies Centroamericanas, reptiles, sugerencias taxonómicas

INTRODUCTION

The year 2015 marked a milestone in Central American herpetology with the publication of a second ever book that covers, in a modern-day format and with quality photographs, all known amphibian and reptilian species of a given country and entirely written by biologists living in that country. A first attempt was previously made in Nicaragua by Ruiz and Buitrago (2003), but that book provided only brief comments on each species covered and included relatively few photographs of amphibians and reptiles from Nicaragua. Numerous taxonomic changes have been proposed in the years subsequent to the publication of Ruiz and Buitrago (2003), thus making much of that book outdated. The newer book in question "Guía Ilustrada de Anfibios y Reptiles de Nicaragua" (2015; HerpetoNica, MARENA, Managua, 522 pp. [hereafter HerpetoNica]) is basically a second edition of the Ruiz and Buitrago (2003) work, and resulted from the first effort by a group of 12 Nicaraguans forming the group "HerpetoNica" (currently HerpetoNica contains 16 members). That group was established on 22 May 2007 and consists entirely of volunteers, most of who are biologists, or have had some previous training in biology. Nine of the 12 members of that group participated in authorship (Ernesto González, Henry López Guevara, José Gabriel Martínez Fonseca, Guillermo José Páiz Salgado, Milton Salazar, Heraldo Salgado, Amauru Ruiz, Javier Sunyer, and Milton Francisco Úbeda Olivas) of HerpetoNica.

Two of those coauthors (Sunyer, Martínez Fonseca) and a foreign biologist (McCranie) join here to comment on, and/or update some geographical distributions, to update the taxonomy, and to discuss several related subjects regarding amphibians and reptiles occurring in HerpetoNica. Unfortunately, HerpetoNica (2015) is not generally for sale, and is being distributed by one of its sponsors (MARENA) and by the authors.

McCranie was not involved in the production of HerpetoNica, but he wants to stress the difficulties biologists in Central American countries have with acquiring literature and also finding the money to purchase books, which can be terribly expensive in those countries. Those books are also usually not available in libraries in those countries. Those difficulties can have much to do with one's ability with trying to stay current with the frequently changing taxonomy and the resulting redefinitions of geographical distributions of Nicaraguan amphibians and reptiles as discussed in this study. Other comments are from recently published research not available at the time HerpetoNica went to press. In addition, English is not the first language of any of the coauthors of HerpetoNica, thus presenting another challenge to those authors, since most taxonomic literature currently being published is in English.

We also take this opportunity to comment on some recently proposed taxonomic decisions involving species occurring in Nicaragua. The most significant of those suggestions involve a documented and now necessary *Rhinella horribilis* type locality restriction and the validity of the genera *Enuliophis* and *Enulius*. We also return to an older taxonomic question regarding *Agalychnis callidryas*, but now with sufficient specimens from neighboring northeastern Honduras in an area previously representing a geographical distribution hiatus that hampered earlier studies on that now known to be a species complex. As a result, the study of those newer specimens of *Agalychnis*, we now suggest elevating the nominal form *A. taylori* from the synonymy of *A. callidryas* based on well-supported external morphological data. In addition, we note a recent disturbing trend in many herpetological studies, is for authors to rely solely on molecular data from scattered or few localities, thus not providing well-defined geographical distributions nor displaying any firsthand knowledge of the morphology of species they are studying (not even examining the specimens from which their genetic data came). As a result, authors of many of those recent studies attempt to divide geographically widespread species into multispecies without providing any knowledge whether or not continuous gene flow occurs between adjacent nominal forms they are recognizing. Those genetic data authors rely on, ideally, should be from throughout a given nominal form's geographical distribution, even if that distribution is rather widespread. If sufficient genetic samples are not available from much of a nominal forms' geographical distribution, then those authors especially need to examine external morphological characteristics from throughout the subjects' geographical distribution. Otherwise, those authors' results are poorly supported and inadequate and make no attempt to determine if their "nominal forms" are reproductively isolated from each other.

METHODS

The comments in the results below are in the same species order as used in HerpetoNica, and also are first listed by the scientific name used in that work. Instead of citing all original literature involved in the following comments, we try to cite the most recent source that summarizes those comments in an effort to shorten the current manuscript. We also include the original geographical distribution information published in HerpetoNica.

RESULTS

Incilius coccifer. The geographical distribution of this toad is from Oaxaca, Mexico, to the Guanacaste region of northwestern Costa Rica (summarized in McCranie and Castañeda, 2007; also see McCranie, 2015). It was said to occur from Mexico to Panama in HerpetoNica.

Incilius valliceps. This nominal form occurs from central Veracruz, Mexico, to Costa Rica (summarized in McCranie and Castañeda, 2007; also see McCranie, 2015). It was said to occur from Texas to Costa Rica in HerpetoNica.

Rhinella marina. This toad was said to occur from the United States to northern South America in HerpetoNica. The "northern populations" of *R. marina* were assigned to the species *R. horribilis* by Acevedo et al. (2016), but those authors overlooked an extremely important, and much more thorough study (Mulcahy et al., 2006). Acevedo et al. (2016), unfortunately did not attempt to clearly define the geographical distribution of their concept of *R. horribilis*, nor did they sequence a sufficient number of tissues from a significant portion of its estimated geographical distribution to help them understand the distribution of that nominal form, but **apparently thought** (emphasis ours) that the species occurred in South America west of the Andes northward to southern Texas, USA. Mulcahy et al. (2006: 1,898) recovered "strong support for a monophyletic Mesoamerican clade of *R. marina*" and also "strong support for an isthmian break" [= Isthmus of Tehuantepec, Mexico] clade. Those results point to that *R.* "*marina*" population occurring north of that isthmus to southern Texas to represent a different nominal form than the population of the Mesoamerican clade south of that isthmus (no Nicaraguan samples were included in the Mulcahy et al. study). The type locality of *R. horribilis* (Wiegmann, 1833: 654) is "in the vicinity of Vera Cruze" [= Veracruz, Mexico]. The correct name for each of these forms north and south of the Isthmus of Tehuantepec, should they be further shown to actually represent two reproductively isolated clades, depends first on which side of the isthmus Wiegmann's *R. horribilis* type locality lies.

Taylor and Smith (1945: 553) proposed the new species *Bufo angustipes*, currently considered a synonym of *R. horribilis*, with a type locality of "La Esperanza, Chiapas" [Mexico], thus, *Rhinella angustipes* new comb. would be available for the "Mesoamerican clade." For stability reasons, and as an aid to future taxonomic work on Mexican and Central American members of the *R. marina* complex, we herein restrict the *R. horribilis* (Wiegmann) type locality to "the vicinity of Veracruz, Mexico, north of the Isthmus of Tehuantepec." A locality north of that isthmus, where the city of Veracruz lies, is also considerably more likely to be the origin of the *R. horribilis* type specimen than would be a locality in the district of Veracruz south of that isthmus, especially since only a rather tiny portion of Veracruz lies south of that isthmus. Thus, in the case of two species being involved, the specimens of the Mesoamerican clade would take the name *Rhinella angustipes* (Taylor and Smith) and those north of that isthmus would keep the name *R. horribilis* (Wiegmann).

Fig. 1. (Left) *Rhinella "horribilis"* from near Puerto Escondido, Oaxaca, Mexico, and (right) *R. "angustipes"* from Escuintla, Guatemala. **Photos:** (left) E. Solana and (right) J. Sunyer.

Fig. 2. *Rhinella "angustipes"* from (left) Isla Exposición, Valle, Honduras, and (right) La Tigra, Rivas, Nicaragua. **Photos:** (left) J. R. McCranie and (right) J. G. Martínez-Fonseca.

Fig. 3. *Rhinella "angustipes"* from (left) Finca Bauminvest, Alajuela, Costa Rica, and (right) Serranía del Pirre, Darién, Panama. **Photos:** (left) J. Sunyer and (right) A. Batista.

Agalychnis callidryas. The authors of HerpetoNica did not give geographical distribution statements for this species outside of Nicaragua. McCranie and Castañeda (2007) wrote that it occurs from central Veracruz and northern Oaxaca, Mexico, to northern Colombia. However, we believe that given distribution contain several nominal forms. We believe two well-supported nominal forms occur in Honduras alone. Duellman (1970: 111) wrote "evidence supports the recognition of three taxa—a northern population from Honduras to México, a central population in Nicaragua and Costa Rica, which apparently intergrades with a third population occurring in Panamá and on the Pacific lowlands of Costa Rica." Duellman (1970: 111) also wrote that specimens "from the Honduranean hiatus" are needed before "formal taxonomic changes" can be made. McCranie (published in McCranie and Wilson, 2002) also discussed that situation with an emphasis on the external morphological characters of those Honduran populations. Subsequently, numerous specimens of this *Agalychnis* have been collected or observed from that Honduran hiatus referred to by Duellman (1970). Those recent collections strongly support the two species concept for the Honduran populations, with the population from west-central Honduras westward and northward to Veracruz, Mexico, taking the name *A. taylori* (Funkhouser, 1957: 34; type locality in Veracruz, Mexico). Thus, we officially propose resurrecting *Agalychnis taylori* (Funkhouser) from the synonymy of *A. callidryas*. *Agalychnis taylori* is apparently isolated from the northeastern Honduran and eastern Nicaraguan *A. callidryas* populations and is distinguished in having the upper arms and the anterior and posterior surfaces of the thighs orange in life and pale brown in preservative, in lacking a longitudinal pale stripe on the flanks, in having less hind limb webbing with a modal formula II 2–3 III 2–3 IV 2 1/2–2 V, and in reaching a shorter adult SVL with a maximum known SVL 48 mm in males and 52 mm in females (those data published in McCranie and Wilson, 2002: 234; also see Duellman, 1970: 111 and below).

Those defining characters occur in the population extending from east-central Honduras to Veracruz, Mexico (also see Duellman, 1970). The distinguishing characters for the northeastern Honduran and Nicaraguan populations are having the upper arms and usually the anterior and posterior surfaces of the thighs blue in life and dark (a brown shade) in preservative, almost always having a distinct, complete or interrupted pale, usually white, longitudinal stripe on the upper flanks, having increased hind limb webbing with a modal formula II 2^{-}–3^{-} III 1^{+}–2 1/2 IV 2–1^{+} V, and reaching a larger SVL with a maximum known SVL 57 mm in males, 77 mm in females) (those data gathered by McCranie and published in McCranie and Wilson, 2002: 234; also discussed in Duellman, 2001). In Nicaragua, this species is relatively variable and is represented in the central Pacific versant, northern highlands, and Caribbean lowlands (Savage and Heyer, 1967; Köhler, 2001). In addition, there are two insular Nicaraguan populations of *A. callidryas* (Cope, 1862: 359; type locality in Darién, Panama) that present distinctive morphological characteristics, such as that of Great Corn Island (in the Caribbean Sea) with an outstanding number of flank bars, and the Ometepe Island population, located in the highlands of the crater of Volcán Maderas (in Lago de Nicaragua on the western portion of the Caribbean versant), which is small in size and deposits substantially fewer eggs than the remaining mainland Caribbean lowland forms. However, morphological characters alone might not be sufficient to resolve the taxonomy of all populations of the *A. callidryas* species complex, at least in Nicaragua. All of these Nicaraguan populations genetically cluster together with those in eastern Honduras and northern Costa Rica (Solano-Flórez, 2012), and although we strongly suspect that this population corresponds to *A. helenae* (Cope, 1885: 182; type locality "Nicaragua"), we prefer not to propose resurrecting *A. helenae* from the synonymy of *A. callidryas* (type locality in Panama) nor describing new forms until a combined morphological and molecular analysis is published.

Fig. 4. *Agalychnis taylori* from (left) Sayaxye, Petén, Guatemala, and (right) Laguna del Cerro, Copán, Honduras. **Photos:** (left) J. Sunyer and (right) J. R. McCranie.

Fig. 5. *Agalychnis callidryas* from (left) Quebrada El Pinol, Olancho, Honduras, and (right) Las Brumas, Chontales, Nicaragua. **Photos:** (left) J. R. McCranie and (right) J. Sunyer.

Fig. 6. *Agalychnis callidryas* from (left) Cerro Kilambé, Jinotega, and (right) El Crucero, Managua, Nicaragua. **Photos:** (left) J. Sunyer and (right) J. G. Martínez-Fonseca.

Cruziohyla calcarifer. According to the revision of Gray (2018), the correct name for the Nicaraguan Caribbean populations of the *Cruziohyla calcarifer* complex (Phyllomedusidae: Bossuyt and Roelants, 2009; Duellman et al., 2016) would be *C. sylviae*. The geographical distribution of *C. sylviae* is from northeastern Honduras to the Darién Province in Panama (Gray, 2018). The geographical distribution of *C. calcarifer* is now "Highly restricted populations occurring in northwest Ecuador, western Colombia, Panama, southeastern Costa Rica" (Gray, 2018).

Hypsiboas rufitelus. According to the revision of Dubois (2017), the name for the species occurring in Nicaragua would be *Boana rufitela*.

Smilisca baudinii. McCranie (2017) suggested treating *Smilisca baudinii* as a species complex. The geographical distribution in HerpetoNica remains generally correct for the *S. baudinii* complex, except the lowland broadleaf rainforest population occurring on the Caribbean versant from northeastern Honduras, and along the east coast of Nicaragua to eastern Costa Rica was treated as a different species by McCranie (2017). McCranie (2017) suggested elevating *Hyla manisorum* Taylor from the synonymy of *S. baudinii* for the Caribbean lowland population just discussed. Thus, *S. manisorum* (Taylor) is the correct name for the *S. baudinii* complex population occurring along the eastern lowlands of Nicaragua. Himes and Enge (2017) recently reported this species from northwestern Panama.

Lithobates forreri. HerpetoNica included Mexico to Costa Rica in the distribution of this species. Luque-Montes et al. (2018) addressed all Nicaraguan ranid frogs within the genus *Rana* (=*Lithobates*) and referred to the populations of leopard frogs from the Pacific lowlands of El Salvador, Honduras, Nicaragua, and Costa Rica as *R.* cf. *forreri* "to reflect the existing evidence that these populations are not conspecific with *R. forreri* sensu stricto" (Luque-Montes et al., 2018: 2), as previously stated by McCranie (2015).

Lithobates taylori. HerpetoNica included Costa Rica and southeastern Nicaragua in its geographical distribution, despite including a locality in northern Nicaragua (Reserva Natural de Datanlí-El Diablo in the department of Jinotega). Luque-Montes et al. (2018) addressed all Nicaraguan ranid frogs within the genus *Rana* (=*Lithobates*) and considered the distribution of *L. taylori* from Costa Rica to a hypothetical contact zone in eastern Honduras and/or northern Nicaragua and stated that the distributional limits and differentiation between *L. brownorum* and *L. taylori* remains uncharacterized.

Laemanctus longipes. The systematics of the isolated central Nicaraguan population that is currently referred to as *L. longipes* needs to be studied (McCranie, 2018).

Norops carpenteri. McCranie and Köhler (2015) included this species from northeastern Honduras. HerpetoNica only included northeastern Nicaragua to northwestern Panama in its geographical distribution.

Norops cupreus. This species also occurs on the Pacific versant of southwestern Honduras (discussed in McCranie and Köhler, 2015; also see next entry). It was said to occur from northern Nicaragua to central Costa Rica in HerpetoNica.

Norops dariense. This species was said to occur in Honduras in HerpetoNica. McCranie and Köhler (2015) tentatively considered *N. dariense* to be a synonym of *N. cupreus* (McCranie and Köhler, 2015 made an effort to investigate the systematics of *N. cupreus* and *N. dariense*, but could not find any morphological characters to consistently define each nominal form from the other). Thus, the morphology and molecular characteristics of this species complex are in need of more study.

However, based on the McCranie and Köhler (2015) external morphological examination of about 350 specimens and our own especially informative experience in the field in both Honduras and Nicaragua (we consider that field experience necessary for any taxonomic decision made regarding anoles; also see a similar opinion in Williams, 1976) with both nominal forms, we can offer the following. We suspect *N. cupreus* is the correct name for the form occurring in open forest along the Pacific versant (from Honduras to northwestern Costa Rica) and *N. dariense* is the correct name for the form occurring in the more humid forests of the central and Caribbean versant of Honduras and Nicaragua. Also, the *N. cupreus* male dewlap has a large (deep) outer border that is white to pale-brown in life along with an orange-brown basal blotch, whereas the *N. dariense* male dewlap has a slightly darker shade of brown or orange-brown outer border with a distinct darker brown to orange-brown basal blotch (although we note that those various tones can be affected by temperature or mood changes).

Norops laeviventris. Fitch and Seigel (1984) suggested that the north-central Nicaraguan population of the *N. laeviventris* species complex represented *N. intermedius*. However, we continue to include *N. laeviventris* as the nominal form for the Nicaraguan population until a detailed study of the Nicaraguan to Panama populations is offered.

Norops tropidonotus. Köhler et al. (2016) revised the systematics and taxonomy of the *N. tropidonotus* species complex. According to that revision, the name for the species occurring in Nicaragua would be *N. mccraniei* (described by Köhler et al., 2016), which ranges from northeastern Guatemala to northern Nicaragua.

Celestus bivittatus. McCranie (2018) transferred this, and several other species, to the genus *Diploglossus*. That decision was based, in part, on a recent phylogenetic analysis (only using molecular data) that recovered the *Celestus-Diploglossus* clade as paraphyletic with respect to each other and with a South American genus (discussed in McCranie, 2018).

Gymnophthalmus speciosus. The geographical distribution of this species (actually a complex of multiple species; see summary in McCranie, 2018) also includes southern Mexico. HerpetoNica reported this species to occur between Guatemala and Colombia.

Ctenosaura quinquecarinata. The authors of HerpetoNica (p. 214) wrote that this species is "endémica trinacional," but only included Nicaragua and Costa Rica in its geographical distribution. This *Ctenosaura* is an extremely common lizard (not declining or threatened as has been frequently said in the literature) at many localities in southern Honduras (discussed in McCranie, 2018).

Sceloporus malachiticus. McCranie (2018) offered a preliminary study of the Honduran populations of this species complex. McCranie (2018), using external morphology and unpublished molecular results, provided two new species descriptions for Honduran populations, elevated one nominal form from synonymy, and discussed several other Honduran populations that likely represent unnamed species. McCranie (2018) did not have specimens of Nicaraguan populations to include in his study of the systematics of this species complex, but expressed his belief that *S. malachiticus* still remained a complex of multiple species. The type locality of *S. malachiticus* is in Costa Rica, so those populations from Nicaragua (exclusive of the northwestern mountain ranges) to western Panama should retain the name *S. malachiticus* until they are studied by a phylogenetic analysis using both morphological and molecular data. In accordance with the distribution maps for this species complex in McCranie (2018), it is highly probable that at least the northernmost populations in Nicaragua correspond to *S. hondurensis*.

Sceloporus squamosus. The authors of HerpetoNica only included Nicaragua in the geographical distribution of this species. *Sceloporus squamosus* is also known to occur on the Pacific versant from Chiapas, Mexico, to northwestern Costa Rica (summarized in McCranie, 2018).

Sphaerodactylus millepunctatus. The geographical distribution for this species, as currently understood, is from eastern Honduras to northern Costa Rica (summarized in McCranie, 2018). Its geographical distribution was given in HerpetoNica as between Mexico and Costa Rica.

Cnemidophorus ruatanus. McCranie (2018) summarized the geographical distribution of this species as being from southeastern Guatemala to northeastern Nicaragua, with a likely introduced population in Belize. It was said to occur between Guatemala and Brazil in HerpetoNica. It also seems likely that additional populations of *C. ruatanus* occur more southerly along the Caribbean coastal zone of eastern Nicaragua.

Holcosus undulatus. Meza-Lázaro and Nieto-Montes de Oca (2015) suggested elevating nine nominal forms previously considered subspecies of *H. undulatus* to species level. Those authors used an old study (Smith and Laufe, 1946) defining numerous subspecies in Mexico and Guatemala with almost no information on *H. undulatus* from Honduras to northwestern Panama. As a result of that poorly substantiated study, Meza-Lázaro and Nieto-Montes de Oca speculated that there were two species of this lizard in Honduras with one restricted to the Caribbean versant in northwestern Honduras and another restricted to the Pacific versant of that country. That suggestion is far from reality as *H. undulatus* occurs throughout both versants in subhumid habitats in Honduras, including across the low elevation continental divide of southern Honduras (see McCranie, 2018).

Meza-Lázaro and Nieto-Montes de Oca (2015) also concluded two species occurred on the Pacific versant of Nicaragua and ignored Caribbean versant populations also occurring in continuous subhumid habitat populations across that same low elevation continental divide. Thus, the Meza-Lázaro and Nieto-Montes de Oca (2015) proposal is poorly supported and not accepted by us.

Anomalepis mexicanus. This species is also known from northeastern Honduras (summarized in McCranie, 2011a). This *Anomalepis* was said to occur between Nicaragua and Peru in HerpetoNica.

Boa imperator. The distribution of this nominal form is apparently from the Isthmus of Tehuantepec, Mexico, through at least Central America (summarized in McCranie, 2018; however, the geographical distribution of this nominal form was not given by Reynolds et al., 2014, the workers making that taxonomic decision). Most South American populations apparently represent other nominal forms (Reynolds et al., 2014). Reynolds et al. (2014) used the nominal forms *B. constrictor, B. c. amarali, B. c. occidentalis, B. imperator,* and *B. i. sabogae* in two of their molecular trees. However, those authors did not provide any morphological support for their proposed classification, and their genetic-based taxonomic decisions were not supported by a sufficient number of tissued specimens from throughout a given nominal forms' geographical distribution. In addition, some of their sequence data came from specimens in zoos and from private breeders, thus those locality data should be considered questionable. Unfortunately, Reynolds et al. (2014) did not provide any information if these nominal forms represented reproductively isolated clades or were part of a wide-ranging reproductively connected clade extending from Mexico to South America. The *B. imperator* geographical distribution was given as between Mexico and Argentina in HerpetoNica.

Dendrophidion apharocybe. Cadle (2012a) concluded that the geographical distribution of this nominal form is from eastern Honduras to near the Panamanian-Colombian border, and also probably in northwestern Colombia. Its overall geographical distribution was not given in HerpetoNica.

Dendrophidion percarinatum. Cadle (2012b) gave the geographical distribution of *D. percarinatum* as northern Honduras to northwestern Colombia and northwestern Venezuela. Its geographical distribution statement in HerpetoNica also included Ecuador.

Dendrophidion rufiterminorum. Cadle and Savage (2012), in their description of this species, gave its geographical distribution as from Belize, Guatemala, and northern Honduras, with a hiatus until southern Nicaragua and Costa Rica.

McCranie (2011a; not cited in Cadle and Savage, 2012; although the second author of that work had a preliminary version of that book manuscript well before it was published) had previously recognized that the South American populations usually associated with this name were not conspecific with the Central American populations. Its geographical distribution statement in HerpetoNica was given as from Ecuador to Belize.

Drymarchon melanurus. The southern portion of the geographical distribution, as currently understood, of this *Drymarchon* extends to northern Venezuela and northwestern Peru (see summary in McCranie, 2011a). Its geographical distribution statement in HerpetoNica was from Texas to Ecuador.

Drymobius rhombifer. This species was said to occur in Honduras in HerpetoNica. However, there are no known specimens (McCranie, 2011a); only a photograph of a dead *D. rhombifer* said to be from "Honduras" appeared on the internet several years ago. A recent internet search did not recover that illustration. Therefore, Nicaragua constitutes the northernmost known limit of distribution of this species as currently documented.

Lampropeltis abnorma. Ruane et al. (2014) described the geographical distribution of *L. abnorma* as southern Veracruz and southeastern Guerrero, Mexico, to western Costa Rica. Its geographical distribution given in HerpetoNica was between southern Canada and Ecuador and Venezuela. However, this is another species defined by genetic data only (Ruane et al., 2014 discussed color pattern as used in an older study to try to support their genetic data, but those color patterns can be extremely variable; Ruane et al., 2014 themselves said those color patterns were unreliable for taxonomic decisions) and from too few tissue samples (apparently only two) to clearly define its "stated" widespread geographical distribution. Also, Ruane et al. (2014) did not consider whether or not the "*abnorma*" section was geographically or reproductively isolated or if it was continuously reproductively connected to those adjacent nominal forms those authors also considered separate species.

Leptophis depressirostris. This species is also known from northeastern Honduras (summarized in McCranie, 2011a). Its geographical distribution given in HerpetoNica was between Nicaragua and Ecuador.

Mastigodryas alternatus. This salmon colored to red bellied *Mastigodryas* is known from eastern Honduras to central Panama, as proposed by McCranie (2011a). Its geographical distribution in HerpetoNica was said to be from Mexico to Panama.

Tantilla armillata. The southern geographical distribution of this *Tantilla* is in central Costa Rica (see summary in McCranie, 2011a). The geographical distribution given for *T. armillata* in HerpetoNica was between Guatemala and Argentina.

Tantilla reticulata. Savage (2002) stated that a specimen from Backas Creek (= Río Baka, 13°35'N, 84°25'W), Department of Atlántico Sur, east-central Nicaragua, previously identified as *T. taeniata* actually represented *T. reticulata*. Thus, its geographical distribution should be given as "east-central Nicaragua to Colombia" and not as southeastern Nicaragua to Colombia as given in HerpetoNica. In addition, one of the three specimens of *T. reticulata* forming the basis of the southeastern Nicaragua records (Köhler, 2001; Sunyer et al., 2014; van den Berghe et al., 2014), from Colorado Junction, was actually collected in Costa Rica (see Savage, 2002).

Tantilla taeniata. The geographical distribution of *T. taeniata* was recently restricted to the vicinity of Guatemala City, Guatemala, by Campbell (1998). McCranie and Smith (2017) provided a morphological study of *T. taeniata* and agreed with Campbell's locality restriction. McCranie and Smith (2017) also described three new species based on all known specimens of the *T. taeniata* group from Honduras, thus providing further evidence that the isolated Nicaraguan populations of this species group are not those of the species *T. taeniata*. Thus, morphological study of the Nicaraguan populations of the *T. taeniata* species group are needed.

Trimorphodon quadruplex. This species occurs from southeastern Guatemala to northwestern Costa Rica (summarized in McCranie, 2011a). The geographical distribution for this species was given in HerpetoNica as between the southern United States and Costa Rica.

Amastridium veliferum. This species occurs from southeastern Nicaragua to Panama. The *Amastridium* population from northwestern Honduras to Nuevo León, Mexico, represent *A. sapperi* (summarized in McCranie, 2011a). The geographical distribution given for this *Amastridium* in HerpetoNica was from Nuevo León, Mexico, to Panama.

Enuliophis sclateri. *Enuliophis* was said to occur from Nicaragua to Colombia in HerpetoNica, but it is also known from northeastern Honduras (summarized in McCranie, 2011a). We also take this opportunity to comment on the taxonomic validity of the genus *Enuliophis*. Myers and McDowell (2014) synonymized *Enuliophis* with *Enulius*, in part because both had similar and unusual maxillary dentition. We disagree with that decision to recognize only one genus among these closely related snakes (also see discussion in McCranie, 2011a and comments in McCranie, 2018). Thus, we continue to recognize both *Enuliophis* and *Enulius* as valid genera. The hemipenes of all four species of *Enulius* (*sensu stricto*) are completely covered with tiny, closely packed spines (spinules). No other dipsadine snake is known to have such hemipenes. Therefore, that character represents a strong synapomorphy to define the genus *Enulius* (*sensu stricto*).

To ignore that unique morphological character state by synonymizing the genus *Enuliophis* with *Enulius* is not based on "taxonomic efficiency" (Myers and McDowell, 2014: 69), nor is it taxonomically informative. Additionally, male hemipenes of *Enuliophis* are unique among all Dipsadidae by having the organ with few, huge, thick, widely spaced spines on its basal half, and few, small, widely spaced spines on its distal half. Thus, those unique hemipenenial characters of *Enuliophis* also represent a synapomorphy to help define it as a valid genus. Comparisons of the illustrations of both the *Enuliophis* and *Enulius* hemipenes in McCranie and Villa (1993) and Myers and McDowell (2014) also demonstrate those two unique character states. Myers and McDowell (2014: 73) called the unique *Enuliophis* and *Enulius* hemipenes as examples of "extreme hemipenial divergencies." Some authors have included the extremely long, thick, fragile tail occurring in both of these genera as a synapomorphy to support synonymizing *Enuliophis* with *Enulius*. However, that tail character also occurs in other Central American genera, not necessarily most closely related to each other (*Pliocercus*, *Scaphiodontophis*, and *Urotheca*).

Fig. 7. *Enuliophis sclateri* from (left) Finca Nogal, Alajuela, Costa Rica, and (right) Bachi Kiamp, Gracias a Dios, Honduras. **Photos:** (left) J. Sunyer and (right) J. R. McCranie.

Fig. 8. *Enuliophis sclateri* from (left) Refugio Bartola, and (right) Boca de Sábalos, Río San Juan, Nicaragua. **Photos:** J. G. Martínez-Fonseca.

Fig. 9. *Enulius flavitorques* from (left) Ometepe Island, Rivas, and (right) Volcán Masaya, Masaya, Nicaragua. **Photos:** (left) J. Sunyer and (right) J. G. Martínez-Fonseca.

Fig. 10. *Enulius flavitorques* from (left) El Abuelo, Rivas, and (right) Loma Alegre, Carazo, Nicaragua. **Photos:** J. G. Martínez-Fonseca.

Leptodeira rhombifera. The geographical distribution of this subhumid habitat occurring species is from central and southern Guatemala to central Panama as discussed in McCranie (2011a). The geographical distribution given for this species in HerpetoNica was from Mexico to Argentina. In a recent and weakly supported color pattern and photographic review of the genus *Leptodeira*, Barrio-Amorós (2019) recognized the geographical distribution of *L. rhombifera* as from southern Mexico to northwestern Costa Rica, and possibly to central Panama.

Leptodeira septentrionalis. McCranie (2011a) redefined the southern portion of the geographical distribution of this largely humid habitat occurring species as central and west-central Costa Rica. The geographical distribution for this species was given in HerpetoNica as from Mexico to Peru.

In their weakly supported "review", Barrio-Amorós (2019) recognized four species within the *L. septentrionalis* species complex, two of which would occur in Nicaragua: *L. polysticta* (southern Veracruz in Mexico to Nicaragua) and *L. ornata* (eastern Honduras to Panama, being unclear its presence in Colombia). Also, according to the Barrio-Amorós (2019) scheme, both of those species would be sympatric in parts of Honduras and Nicaragua, which is certainly not true. More likely those two nominal forms represent a continuously distributed reproductively connected single species.

Sibon annulatus. This species has also been reported from northeastern Honduras (summarized in McCranie, 2011a). The geographical distribution for this species was given in HerpetoNica as from Nicaragua to Panama.

Urotheca decipiens. This *Urotheca* has also been reported from northeastern Honduras (summarized in McCranie, 2011a). *Urotheca decipiens* was said to occur from Nicaragua to Colombia in HerpetoNica.

Xenodon angustirostris. Myers and McDowell (2014: 89) resurrected this nominal form from the synonymy of *X. rabdocephalus*. Myers and McDowell (2014) wrote that *X. angustirostris* was "tentatively resurrected for Central American and some Colombian specimens." Thus, that resurrection and those authors' geographical distribution statement are not well supported (Myers and McDowell, 2014, also admitted, their taxonomic decision was not well supported). The geographical distribution for this species was given in HerpetoNica as from Mexico to Brazil.

Epictia ater. McCranie and Hedges (2016) gave the geographical distribution of *E. ater* as from western Honduras to northwestern Costa Rica (also first suggested in McCranie, 2011a). The geographical distribution for this species was given in HerpetoNica as from Nicaragua to Costa Rica.

Scaphiodontophis venustissimus. This species occurs from northeastern Honduras to north-central Colombia (summarized in McCranie, 2011a). The geographical distribution for this species was given in HerpetoNica as from Mexico to Colombia.

Crotalus simus. The geographical distribution of this nominal form is from Oaxaca and Veracruz, Mexico, to west-central Costa Rica (see summary in McCranie, 2011a). The geographical distribution for this species was given in HerpetoNica as from Mexico to Argentina.

Porthidium nasutum. The geographical distribution of this species apparently extends to northwestern Colombia (summarized in McCranie, 2011a). The geographical distribution given for this species in HerpetoNica was from Mexico to Panama.

Porthidium ophryomegas. McCranie (2011a) summarized the geographical distribution of this species as extending southward only to west-central Costa Rica.

The geographical distribution for this species was given in HerpetoNica as from Guatemala to Panama. There are no known records for this species from Panama.

Chelydra acutirostris. This turtle is known from east-central Honduras to Ecuador (discussed in McCranie, 2018). Its geographical distribution was given in HerpetoNica as from the United States to Ecuador.

Trachemys grayi. *Trachemys emolli* is the correct name for this species on the Pacific versant in Nicaragua. That species occurs from extreme southeastern El Salvador (Golfo de Fonseca) to northwestern Costa Rica (discussed in McCranie, 2018). Its geographical distribution was given in HerpetoNica as from northern Nicaragua to northern Costa Rica.

Trachemys ornata. The correct name for this species on the Caribbean versant in Nicaragua is *T. venusta* as currently known. The geographical distribution of *T. venusta* is not well known (given as southern Mexico through all of Caribbean coastal Central America in HerpetoNica), but appears to occur from at least Veracruz, Mexico, to apparently at least Panama. McCranie (2018) commented on several taxonomic problems associated with that just stated geographical distribution of *T. venusta,* as well as other populations north of Veracruz, Mexico.

Kinosternon scorpioides. The type locality of this turtle species is "Surinam." Thus if one includes this nominal form as occurring in Nicaragua, then its geographical distribution has to also include South America. Its geographical distribution was given in HerpetoNica as from Mexico to Costa Rica. McCranie (2018) advocated using the name *K. albogulare* for most Central American populations of this species complex, including those in Nicaragua. That decision to resurrect *K. albogulare* was based on several recent phylogenetic analyses (both published and unpublished), and on McCranie's study of morphological characters. The northern limits of the geographic distribution of *K. albogulare* are not well known because of conflicting statements in the literature concerning an important morphological character (discussed in McCranie, 2018). However, *K. albogulare* occurs at least from El Salvador and the Yucatán Peninsular, Mexico, to Panama. It also occurs on Isla San Andres, Colombia, but that population is likely a recent introduction, despite some workers curiously considering that population to be distinct at the subspecies level.

The upper elevational limits of several species in HerpetoNica are based on references from other countries and do not correspond with the known elevational ranges within Nicaragua. Some of these species include the following (elevational limit provided in HerpetoNica vs. elevational limit within Nicaragua provided by Sunyer and Köhler, 2010): *Sachatamia albomaculata* (1,500 m vs. 400 m); *Craugastor talamancae* (646 m vs. 420 m); *Phyllobates lugubris* (600 m vs. 420 m); *Diasporus diastema* (1,620 m vs. 1,465 m); *Dendropsophus phlebodes* (700 m vs. 50 m); *Ecnomiohyla miliaria* (900 m vs. 20 m; *Ptychohyla hypomykter* (1,850 m vs. 1,600 m); *Smilisca sordida* (1,200 m vs. 420 m); *Basiliscus plumifrons* (800 m vs. 400 m); *Laemanctus longipes* (1,200 m vs. 1,100 m); *Diploglossus bilobatus* (1,300

m vs. 400 m); *Ctenosaura quinquecarinata* (900 m vs. 330 m); *Diploglossus monotropis* (320 m vs. 50 m); *Lepidoblepharis xanthostigma* (1,300 m vs. 420 m); *Sphaerodactylus argus* (1,400 m vs. 30 m); *Sphaerodactylus millepunctatus* (1,200 m vs. 960 m); *Scincella cherriei* (1,300 m vs. 860 m); *Corallus annulatus* (400 m vs. 185 m); *Loxocemus bicolor* (600 m vs. 480 m); *Chironius grandisquamis* (1,600 m vs. 400 m); *Dendrophidion percarinatum* (1,000 m vs. 260 m); *Tantilla alticola* (2,700 m vs. 1,400 m); *Tantilla vermiformis* (520 m vs. 90 m); *Clelia clelia* (1,000 m vs. 420 m); *Coniophanes fissidens* (1,800 m vs. 1,200 m); *Coniophanes piceivittis* (1,200 m vs. 1,000 m); *Ninia maculata* (1,700 m vs. 1,200 m); *Tretanorhinus nigroluteus* (750 m vs. 220 m); *Pliocercus euryzonus* (1,300 m vs. 1,200 m); *Xenodon angustirostris* (1,300 m vs. 1,200 m); *Thamnophis marcianus* (1,000 m vs. 100 m); *Thamnophis proximus* (2,400 m vs. 1,200 m); *Micrurus alleni* (1,400 m vs. 830 m); *Micrurus multifasciatus* (1,200 m vs. 210 m); *Atropoides mexicanus* (1,400 m vs. 990 m); *Bothrops asper* (1,000 m vs. 780 m); and *Porthidium ophryomegas* (1,000 m vs. 600 m).

Other species were recorded in HerpetoNica from lower elevations than those recorded by Sunyer and Köhler (2010) for Nicaragua: *Craugastor fitzingeri* (1,360 m vs. 1,455 m); *Craugastor lauraster* (1,200 m vs. 1,535 m); *Craugastor mimus* (1,330 m vs. 1,625 m); *Pristimantis cerasinus* (920 m vs. 1,360 m); *Dendrobates auratus* (100 m vs. 280 m); *Oophaga pumilio* (500 m vs. 960 m); *Agalychnis callidryas* (1,000 m vs. 1,325 m); *Dendropsophus microcephalus* (1,000 m vs. 1,300 m); *Scinax elaeochrous* (1,000 m vs. 1,200 m); *Smilisca baudinii* (1,000 m vs. 1,350 m); *Smilisca phaeota* (1,000 m vs. 1,455 m); *Tlalocohyla loquax* (1,000 m vs. 1,350 m); *Lithobates forreri* (1,000 m vs. 1,280 m); *Lithobates warszewitschii* (200 m vs. 1,000 m); *Corytophanes cristatus* (1,000 m vs. 1,100 m); *Norops biporcatus* (1,200 m vs. 1,300 m); *Ctenosaura similis* (800 m vs. 1,030 m); *Sceloporus variabilis* (800 m vs. 1,350 m); *Gonatodes albogularis* (530 m vs. 800 m; *Drymobius chloroticus* (1,000 m vs. 1,200 m); *Scolecophis atrocinctus* (700 m vs. 960 m); *Tantilla taeniata* (700 m vs. 1,230 m); *Trimorphodon quadruplex* (600 m vs. 800 m); *Coniophanes bipunctatus* (400 m vs. 700 m); *Erythrolamprus mimus* (1,200 m vs. 1,460 m); *Geophis hoffmanni* (500 m vs. 960 m); *Micrurus nigrocinctus* (1,200 m vs. 1,400 m); *Epictia ater* (1,000 m vs. 1,100 m); and *Agkistrodon howardgloydi* (300 m vs. 400 m).

Finally, HerpetoNica provides a random degree of details of the distribution of each species within Nicaragua. Several species descriptions have a detailed departmental distribution, which in some cases include unpublished data. However, in the specific case of *Ptychohyla hypomykter*, it was said to occur in the Rivas department in HerpetoNica, but we find that unlikely given its known distribution and we prefer not to include it in the checklist of this department until a voucher or photographs are published.

Remarks. After the publication of HerpetoNica, Phillips et al. (2015) reported the first record of *Norops humilis* from Nicaragua, Loza et al. (2017) reported the first record of *Rhadinella godmani* from Nicaragua, Fernández et al. (2017) reported the first vouchered specimen of *Cerrophidion wilsoni* from Nicaragua, Salazar-Saavedra et al. (2018) reported the first vouchered specimens of *Scaphiodontophis annulatus* from Nicaragua, and Martínez-Fonseca et al. (2019) reported the first confirmed record of *Rhinobothryum bovallii* from Nicaragua. Three introduced species, *Eleutherodactylus planirostris* (Villa, 2015; but without documentation), *Indotyphlops braminus* (Leets-Rodríguez et al., 2019), and *Chelonoidis carbonarius* (Salazar et al., 2015), have recently been reported from Nicaragua. Also, an endemic species, *Epictia rioignis*, has recently been described based on eight specimens from "Corinto, presumably Nicaragua" collected over a century ago (Koch et al., 2019).

HerpetoNica also included six species from Nicaragua as "nuevos registros". However, only two of those species, *Norops humilis* and *Scaphiodontophis annulatus*, have been reported from Nicaragua (Phillips et al., 2015; Salazar-Saavedra et al., 2018). Although we have not seen voucher specimens from Nicaragua of the remaining four species, one (*Leptodactylus poecilochilus*) is likely to occur in Nicaragua (see below). The remaining three species, *Bolitoglossa lignicolor*, *Incilius leucomyos*, and *Norops cryptolimifrons*, are unlikely to occur in Nicaragua, and those "latest findings" are likely based on misidentifications.

SPECIES OF AMPHIBIANS AND REPTILES PROBABLY OCCURRING IN NICARAGUA

Bolitoglossa colonnea. This uncommonly seen salamander is known to occur in the humid lowland broadleaf forest of northeastern Costa Rica (Savage, 2002; based on a spot locality map only, no supporting data offered). Thus, this species likely occurs in similar forest in southeastern Nicaragua.

Fig. 11. *Bolitoglossa colonnea* from Serranía de Tabasará, Ngöbe Buglé, Panama. **Photos:** J. Sunyer.

Fig. 12. *Bolitoglossa colonnea* from (left) Bosque Protector Palo Seco, Ngöbe Buglé, and (right) Río Chilagres, Veraguas, Panama. **Photos:** (left) A. Batista and (right) S. Lotzkat.

Bolitoglossa mexicana. This salamander is quite common in the closed canopy lowland broadleaf forest of the Mosquitia of northeastern Honduras (see map in McCranie and Castañeda, 2007 and supportive locality data in McCranie, 2006). Several of those known localities for *B. mexicana* are within a few km of the Nicaraguan border. Therefore, *B. mexicana* should occur in the similar and historically continuous forest in northeastern Nicaragua.

Fig. 13. *Bolitoglossa mexicana* from (left) Sierra del Caral, Izabal, Guatemala, and (right) Concha Kiamp, Gracias a Dios, Honduras. **Photos:** (left) M. E. Acevedo and (right) J. R. McCranie.

Oedipina gracilis. The *Bolitoglossa colonnea* comments previously made also closely resemble the situation of the moderately common *O. gracilis*. Thus, *O. gracilis* seems likely to occur in the lowland broadleaf forest of extreme southeastern Nicaragua.

Fig. 14. *Oedipina gracilis* from Santa Elena Biological Reserve, Puntarenas, Costa Rica. **Photos:** W. Leonard.

Oedipina quadra. The *Bolitoglossa mexicana* comments just made also closely resemble the situation in *O. quadra*. Thus, *O. quadra* seems certain to occur in the lowland broadleaf forest of at least extreme northeastern Nicaragua.

Fig. 15. *Oedipina quadra* from confluence of Ríos Yanguay and Wampú, Olancho, Honduras. **Photos:** J. R. McCranie.

Hyalinobatrachium chirripoi. This species (as *H. cardiacalyptum*) has been recorded from several lowland broadleaf forest localities in northeastern Honduras. *Hyalinobatrachium chirripoi* is also known to occur in similar habitat in southeastern Costa Rica, Panama, and Colombia (see literature-only summary in Savage, 2002). Thus, if *H. cardiacalyptum* and *H. chirripoi* are indeed conspecific (doubt about only one species being involved remains questionable to McCranie) as has been suggested, then *H. chirripoi* should occur in Nicaragua. If *H. cardiacalyptum* and *H. chirripoi* are shown to not be conspecific, then *H. cardiacalyptum* should occur in lowland broadleaf in northeastern Nicaragua (see map in McCranie and Castañeda, 2007 and supportive locality data in McCranie, 2006).

Fig. 16. *Hyalinobatrachium chirripoi* from Caño El Cajón, Olancho, Honduras. **Photo:** J. R. McCranie.

Hyalinobatrachium colymbiphyllum. This usually common glass frog is an inhabitant of the humid forests of eastern Costa Rica. One of those localities is within a relatively few km from the southeastern Nicaraguan border (Savage, 2002; dot locality map only, no supporting data given). Thus, this species should occur in similar habitat in southeastern Nicaragua.

Fig. 17. *Hyalinobatrachium colymbiphyllum* from Seranía de Majé, Chepo, Panama. **Photo:** A. Batista.

Craugastor gollmeri. This *Craugastor* is found in the lowland broadleaf forest of eastern Costa Rica. Some of those Costa Rican localities are within a relatively few km from the southeastern Nicaraguan border (IUCN SSC Amphibian Specialist Group, 2015). Thus, this species likely occurs in similar habitat in southeastern Nicaragua.

Fig. 18. *Craugastor gollmeri* from La Fortuna, Chiriquí, Panama. **Photo:** S. Lotzkat.

Craugastor polyptychus. This species was said by Savage (2002) to differ from *C. bransfordii* by lacking nuptial pads in adult males, which are present in *C. bransfordii*. The lectotype of *C. polyptychus* is an adult female from between Machuca and San Juan del Norte, southeastern Nicaragua. Savage (2002) considered both *C. bransfordii* and *C. polyptychus* valid species and apparently both occurring in Costa Rica. Sunyer and Köhler (2010) failed to locate a population in southeastern Nicaragua in which adult males lacked nuptial pads. Thus, Sunyer and Köhler (2010) and HerpetoNica assigned all *Craugastor bransfordii* group frogs from southeastern Nicaragua to *C. bransfordii*. Whether the name *C. polyptychus* is to be considered a junior synonym of *C. bransfordii* or to represent a valid species needs study in order to establish the status of this taxon.

Fig. 19. *Craugastor polyptychus* from (left) Heredia, and (right) Limón, Costa Rica. **Photos:** S. Lotzkat.

Pristimantis cruentus. This species of *Pristimantis* is found in the lowland broadleaf forest of northeastern Costa Rica. Some of those Costa Rican localities are rather close to the southern Nicaraguan border (Savage, 2002; spot localities on a map only, supportive data not given). Thus, this species might occur in similar habitat in southeastern Nicaragua.

Fig. 20. *Pristimantis cruentus* from Serranía de Tabasará, Ngöbe Buglé, Panama. **Photos:** J. Sunyer.

Fig. 21. *Pristimantis cruentus* from (left) Bosque Protector Palo Seco, Ngöbe Buglé, and (right) Eldeabajo, Veraguas, Panama. **Photos:** (left) A. Batista and (right) S. Lotzkat.

Eleutherodactylus johnstonei. This Caribbean species is often introduced as a stowaway via trade on several Caribbean localities, including Costa Rica, Panama, Colombia, and Venezuela (AmphibiaWeb, 2019) and is conceivable that it could reach and prosper in Nicaraguan territory.

Fig. 22. *Eleutherodactylus johnstonei* from Cariaprima, Carabobo, Venezuela. **Photo:** J. Sunyer.

Silverstoneia flotator. This common *Silverstoneia* is known from lowland broadleaf forest in eastern Costa Rica. Some of those Costa Rican localities are close to the southeastern Nicaraguan border (Savage, 2002 spot localities on a map only, supportive data not provided). Thus, this species likely occurs in similar habitat in extreme southeastern Nicaragua.

Fig. 23. *Silverstoneia flotator* from (left) Limón, Costa Rica, and (right) Donoso, Colón, Panama. **Photos:** (left) S. Lotzkat and (right) A. Batista.

Anotheca spinosa. This rather difficult to find frog is known to occur in the Mosquitia lowland broadleaf forest of northeastern Honduras (see map in McCranie and Castañeda, 2007 and supportive locality data in McCranie, 2006), thus should occur in similar forest in northeastern Nicaragua. Also, this species is known from undisturbed premontane forest and also marginally from lowland rainforest in Costa Rica south of Nicaragua. Therefore, this species certainly also occurs in similar habitats in central and eastern Nicaragua.

Fig. 24. *Anotheca spinosa* from Costa Rica (captive individuals). **Photos:** S. Lotzkat.

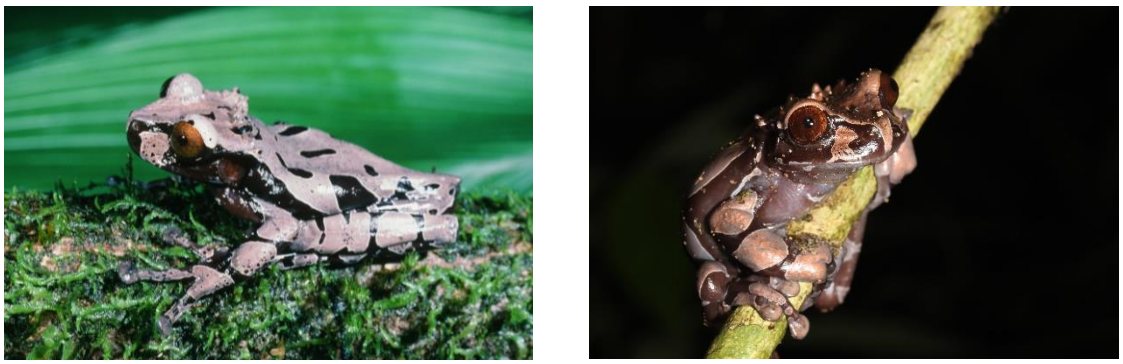

Fig. 25. *Anotheca spinosa* from (left) Bodega de Río Tapalwás, Gracias a Dios, Honduras, and (right) Parque Nacional Soberanía, Panamá Oeste, Panama. **Photos:** (left) J. R. McCranie and (right) A. Batista.

Leptodactylus poecilochilus. This relatively common *Leptodactylus* can be found in open and disturbed situations of the Pacific lowlands of northwestern Costa Rica. Some of those Costa Rican localities are relatively close to the southern Nicaraguan border (Savage, 2002; spot locality map only, supportive data not given). Thus, this species should be found in similar habitat in southern Nicaragua. HerpetoNica included this species from Nicaragua in their list of new records. However, they did not provide evidence or vouchers for that report.

Fig. 26. *Leptodactylus poecilochilus* from (left) Guanacaste, Costa Rica, and (right) Bocas del Toro, Panama. **Photos:** (left) S. Lotzkat and (right) J. Sunyer.

Loxopholis rugiceps. Mora et al. (2019) recently reported this gymnophthalmid species from widely disjunct populations in northwestern Honduras and southeastern Costa Rica, thus extending its known geographical distribution northward from Bocas del Toro, Panama. The reported Honduran locality is in an area that has been highly disturbed for a century or more. Thus, it is possible that this species could occur in disturbed or coastal areas in eastern Nicaragua.

Fig. 27. *Loxopholis rugiceps* from San San Pond Sak, Bocas del Toro, Panama. **Photos:** S. Lotzkat.

Fig. 28. *Loxopholis rugiceps* from San San Pond Sak, Bocas del Toro, Panama. (Left) Dorsolateral and (right) ventral views of head. **Photos:** S. Lotzkat.

Loxopholis southi. This gymnophthalmid species occurs in the lowland broadleaf forest of northeastern Costa Rica. One of the Costa Rican localities is rather close to the southeastern Nicaraguan border (Savage, 2002; spot locality map only, without supportive data). Thus, this species might be found in similar habitat in southeastern Nicaragua.

Fig. 29. *Loxopholis southi* from (left) Bocas del Toro, Panama, and Cerro Azul, Panamá, Panama. **Photos:** (left) J. Sunyer and (right) S. Lotzkat.

Fig. 30. *Loxopholis southi* from (left) Parque Nacional General de División Omar Torrijos Herrera, Coclé, and (right) San San Pond Sak, Bocas del Toro, Panama. **Photos:** S. Lotzkat.

***Hemidactylus* sp.** Invasive geckos of the genus *Hemidactylus* have colonized most portions of tropical America (McCranie, 2018). In Nicaragua, only one species (*H. frenatus*) has been recorded and we find it likely for more species of the genus to be found in the country as research continues.

Fig. 31. Examples of geckos of the genus *Hemidactylus* introduced in Central America: (left) *H. mabouia* from Isla Cisne Grande, Gracias a Dios, Honduras, and (right) *H. turcicus* from Laguna del Tigre, Petén, Guatemala. **Photos:** (left) J. R. McCranie and (right) M. E. Acevedo.

Aristelliger georgeensis complex. Lizards of the genus *Aristelliger* occurs on numerous Caribbean cays and islands (including former Nicaraguan San Andrés and Providencia) and as well as in several mainland localities in Mexico and Belize (McCranie, 2018). Most of Nicaraguan Caribbean cays and a considerable portion of its mainland Caribbean coastline have not been herpetologically sampled and therefore it is conceivable that this species complex could be found in the country.

Fig. 32. *Aristelliger georgeensis* complex from (left) Cayo Becerro Grande, Gracias a Dios, Honduras, and (right) Isla de San Andrés, San Andrés, Colombia. **Photos:** (left) J. R. McCranie and (right) S. Serna-Muñoz.

Epicrates cenchria. This uncommonly seen *Epicrates* can be found in the lowland dry Pacific forest of northwestern Costa Rica. Some of those Costa Rican localities are within a relatively few km from the southwestern Nicaraguan border (Savage, 2002; spot locality map only and without support). Thus, this species might occur in similar habitat in extreme southwestern Nicaragua, but the Pacific versant in that part of Nicaragua is extremely narrow.

Fig. 33. *Epicrates cenchria* from (left) Las Lomas, Chiriquí, Panama (captive individual), and (right) along rio Madeiras, Amazonia, Brazil. **Photos:** (left) S. Lotzkat and (right) J. G. Martínez-Fonseca.

Mastigodryas melanolomus. This snake is known from a few open forest localities in cocotales and pine savanna in the Caribbean lowlands close to the coast in extreme northeastern Honduras (McCranie, 2011a). Similar coastal situations in extreme northeastern Nicaragua should be searched for this species, where it also likely occurs. The Nicaraguan population of this snake was called *M. melanolomus* in HerpetoNica (2015), even though McCranie (2011a) had transferred the Nicaraguan population to *M. alternatus*.

Fig. 34. *Mastigodryas melanolomus* from La Playona, Copán, Honduras. **Photo:** J. R. McCranie.

Tantilla psittaca. McCranie (2011b) described this species based on a few specimens from lowland localities, in both closed canopy and in open situations in northeastern Honduras. Several of those localities are rather close to the adjacent Nicaraguan border. Thus, that *Tantilla* should occur in northeastern Nicaragua (also see *T. taeniata* above).

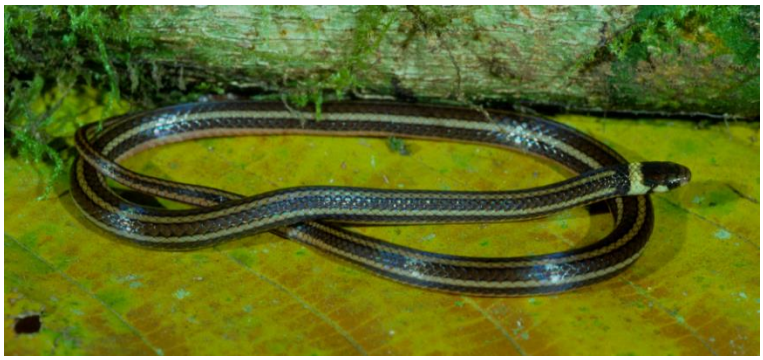

Fig. 35. *Tantilla psittaca* from Rawa Kiamp, Gracias a Dios, Honduras. **Photo:** J. R. McCranie.

Coniophanes imperialis. This snake is known from several open habitat situations in northeastern Honduras close to the Nicaraguan border (McCranie, 2011a). Therefore, this *Coniophanes* seems certain to occur in similar habitat in extreme northeastern Nicaragua.

Fig. 36. *Coniophanes imperialis* from (left) from BFree station, Toledo, Belize, and (right) Puerto Lempira, Gracias a Dios, Honduras. **Photos:** (left) E. P. Westeen and (right) J. R. McCranie.

Sibon carri. This *Sibon* is an inhabitant of the subhumid forest of the Pacific lowlands of southern Honduras (McCranie, 2011a). Some of the Honduran localities for *S. carri* are within a relatively few km of the Nicaraguan border (McCranie, 2011a). Thus, this species seems likely to occur in similar habitat in at least extreme northwestern Nicaragua.

Fig. 37. *Sibon carri* from 25.7 km NW of La Esperanza, Intibucá, Honduras. **Photo:** J. R. McCranie.

Finally, frogs of the genera *Duellmanohyla* and *Isthmohyla* are distributed from northern Oaxaca, Mexico, and eastern Guatemala, respectively, to western Panama (McCranie and Castañeda, 2007; S. M. Rovito, pers. comm. to McCranie). However, no specimens of these genera have been recorded from Nicaragua (Sunyer and Köhler, 2010). Also, Köhler (2001) reported collecting tadpoles, metamorphs, and juveniles of an unknown species of *Plectrohyla* at Cerro Salsaya in northeastern Nicaragua.

Despite subsequent field trips to Cerro Salsaya, no further specimens of a *Plectrohyla* have been collected, and the identity of that population remains unclear.

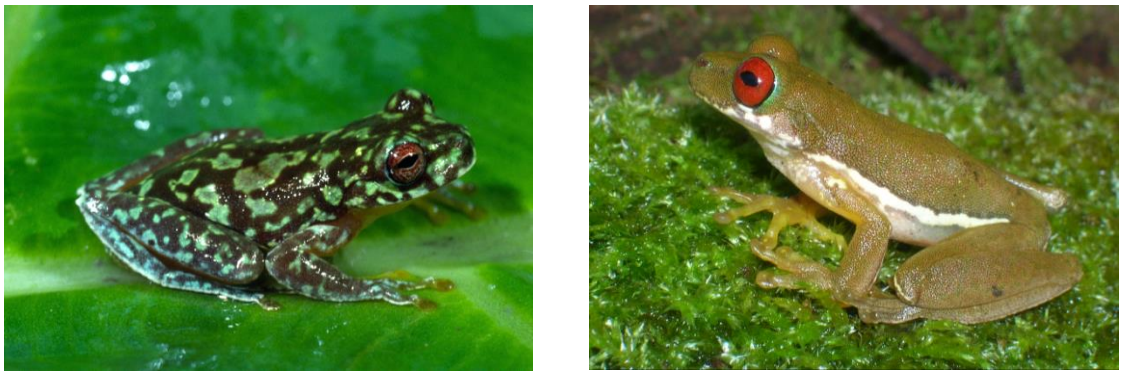

Fig. 38. Examples of Central American frogs of the genus *Duellmanohlya*: (left) *D. soralia* from Quebrada Grande, Copán, Honduras, and (right) *D. rufioculis* from Cerro Cacao, Guanacaste, Costa Rica. **Photos:** (left) J. R. McCranie and (right) J. Sunyer.

Fig. 39. Examples of Central American frogs of the genus *Isthmohyla*: (left) *I. insolita* from 2.5 airline km NNW of La Fortuna, Yoro, Honduras, and (right) *I. zeteki* from Serranía de Tabasará, Ngöbe Buglé, Panama. **Photos:** (left) J. R. McCranie and (right) J. Sunyer.

Fig. 40. Examples of Central American frogs of the genus *Plectrohyla*: (left) *P. guatemalensis* from (left) near Panajachel, and (right) *P. matudai* from Los Tarrales, Sololá, Guatemala. **Photos:** J. Sunyer.

DISCUSSION

We hope that the taxonomic comments discussed in this study, and our updated geographical distribution statements will be of help to biologists interested in the herpetofauna of Central America. We also hope that our taxonomic decisions and comments will spur some helpful debate, and even better, spur someone to undertake new taxonomic studies regarding our conclusions. The comments and conclusions presented in this note also should be of use to those people with limited access to much of the literature concerning Central American amphibians and reptiles. Our comments are made more important by the rapid pace of taxonomic changes being proposed. Those interested people living in Nicaragua, who might have access to a copy of HerpetoNica, would especially benefit from this open access note.

Finally, we comment on a disturbing trend in recent literature for authors to not convincingly define the geographical distributions, nor to provide helpful external morphological descriptions (or not even examining specimens of the species they are "studying"), of the species they are resurrecting or considering valid. Those instances mostly regard studies based on molecular only data with amazingly few tissued specimens of widely distributed taxa utilized.

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Apartado Postal 527, 21000 León, NICARAGUA
Teléfono (505) 2311-6586
jmmaes@bio-nica.info
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