

2006

Leptodactylus fragilis

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Recommended Citation

Heyer, W.R., M. H. Heyer, and R. O. de Sá. 2007 *Leptodactylus fragilis* account. *Catalogue of American Amphibians and Reptiles* 830.1-830.26. URI: <http://hdl.handle.net/2152/44672>

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AMPHIBIA: ANURA: LEPTODACTYLIDAE

Leptodactylus fragilis

Catalogue of American Amphibians and Reptiles.

Heyer, M.M., W.R. Heyer, and R.O. de Sá. 2006.
Leptodactylus fragilis.

***Leptodactylus fragilis* (Brocchi)**
White-lipped Thin-toed Frog

Cystignathus gracilis: Cope 1870:162.

Cystignathus caliginosus: Brocchi 1877:180.

Cystignathus fragilis Brocchi 1877:182. Type-locality, "Cet animal a été envoyé de Tehuantepec (Mexique)." Holotype, Muséum National d'Histoire Naturelle, Paris (MNHN) 6316, female, collected by M. Sumichrast (examined by WRH).

Cystignathus labialis: Cope 1879:265.

Leptodactylus albilabris: Boulenger 1881:30.

Leptodactylus caliginosus: Brocchi 1882:17.

Leptodactylus fragilis: Brocchi 1882:19. First usage associating *fragilis* with the genus *Leptodactylus*.

Leptodactylus gracilis: Cope 1887:17.

Leptodactylus labialis: Ives 1892:461.

Leptodactylus melanotus: Dunn and Emlen 1932:22 (part).

Leptodactylus albilebris: Pratt 1935:164. *Lapsus*.

Leptodactylus mystaceus labialis: Shreve 1957:246.

Leptodactylus labialus: Wilczynski, Rand, and Ryan 2001 [2002]:149. *Lapsus*.

Leptodactylus cf labialis-fragilis: Flores-Villela 1993a:260.

• **CONTENT.** The species is monotypic.

• **DEFINITION.** Adult *Leptodactylus fragilis* are small. The head is longer than wide, and the hind limbs are moderately long (Table 1; Heyer and Thompson 2000 provided definitions of adult size and leg length categories for *Leptodactylus*). Male vocal

Table 1. Summary measurement data for *Leptodactylus fragilis* (means are in parentheses).

Measurement	Males	Females
SVL (mm)	27-43 (34.8)	30-44 (36.4)
HL/SVL (%)	35-42 (38)	34-42 (37)
HW/SVL (%)	29-38 (34)	29-37 (33)
Thigh length/SVL (%)	32-46 (39)	32-44 (39)
Shank length/SVL (%)	39-51 (45)	37-53 (46)
Foot length/SVL (%)	41-57 (49)	40-56 (49)

sacs are laterally expanded and range from lightly gray speckled to darkly pigmented. Male snout is spatulate; female snout is rounded. Male forearms



Figure 1. *Leptodactylus fragilis*, USNM 563465, Rus Rus, Gracias a Dios, Honduras. Photograph courtesy of James R. McCranie.



Figure 2. *Leptodactylus fragilis*, ASU 17034, Starr County, Texas. Photograph courtesy of Wayne Van Devender.

are not hypertrophied and males lack asperities on the thumbs and chest. The dorsum is spotted or blotched with dark markings, which are often chevron-shaped and sometimes confluent. The supratympanic fold is dark brown. A pair of dorsolateral folds is usually poorly developed, extending from the posterior portion of the eye, passing just lateral to the sacral bones and ending in the upper groin region at the leg; the folds are often highlighted by dark and/or light stripes. A pair of lateral folds extends from the posterior dorsal portion of the tympanic fold to the mid-groin level at the leg juncture; the folds are often interrupted and/or poorly developed and are usually of lighter color than the adjacent flanks. The toe tips are rounded, either of equal diameter or slightly greater than the toe portion immediately behind the tip. The toes either lack lateral ridges and basal webbing or have very weakly developed lateral ridges (most developed proximally) and a trace of basal webbing between some or all toes I-II-III-IV. The dorsal surface of the shank is usually covered with many white tubercles, or sometimes the white tubercles are few and scattered. The posterior surface of the tarsus either has many white tubercles (89%), or is smooth (11%). The sole of the foot always has many white tubercles. A light lip stripe extending from under the nostrils, passing under the eye and tympanum and continuing through the commissural gland is usually poorly developed (97%) or rarely distinct (3%). An

interrupted mid-dorsal dark pin-stripe is occasionally present. The belly is often cream colored (lacking melanophores), it may have a scattering of melanophores to scattered diffuse dark blotches anteriorly and on the sides, or there may be scattered melanophores over the entire belly. The posterior surface of the thigh usually has a very distinct light longitudinal stripe on the lower half (66%), often moderately distinct (33%), or rarely absent (1%).

Larvae are exotrophic, lentic, benthic guild members (McDiarmid and Altig 1999, guild IIA1). Larval morphological characteristics of *L. fragilis* were included in the comparisons with other larvae of the *L. fuscus* group by Langone and de Sá (2005). The oral disk is anteroventrally positioned, entire (not emarginated), and has a broad anterior gap lacking marginal papillae. Submarginal papillae, if present, are not clearly distinguishable from the marginal papillae. The tooth row formula is 2(2)/3(1) (see **Remarks**). Tooth row A-2 is broadly interrupted, while row P-1 is narrowly interrupted. Row P-3 is noticeably shorter than rows P-1 and P-2. The spiracle is sinistral and the vent tube is median. The dorsal fin originates at the posterior end of the body. Larval total length at Gosner stage 32–34 ranges from 22–32 mm. Body length of stage 32–41 larvae ranges from 8–12 mm. Tail length is 63–67% of total length. Eye diameter is 12–16% of body length. The width of the oral disk is 17–22% of body length. A lateral line system is not evident. The dorsum of the body is uniformly suffused with melanophores. A greater concentration of melanophores is situated posteromedially to the nostrils (best seen from dorsal perspective). The spiracle is either lighter or not much lighter than its surroundings. The mouthparts and the region immediately posterior to the oral disk are patternless or marked with a few scattered melanophores. The rest of the anterior venter is scattered with melanophores. The posterior portion of the venter and anal tube are either patternless or with very few scattered melanophores. The tail (both musculature and fins) has scat-

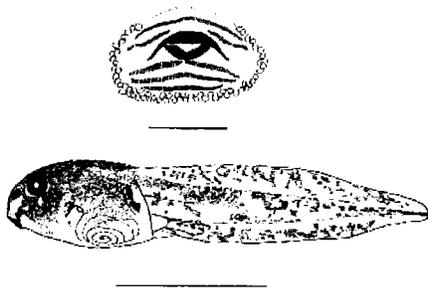


Figure 3. Tadpole of *Leptodactylus fragilis*, figures 7 and 17 in Heyer (1970b), based on specimen from Costa Rica. Upper scale bar = 1 mm, lower scale bar = 10 mm. Tail myotomes not illustrated.

tered groupings of melanophores forming blotched patterns.

The advertisement call consists of a single note (usually) or two notes per call given at rates of 120–

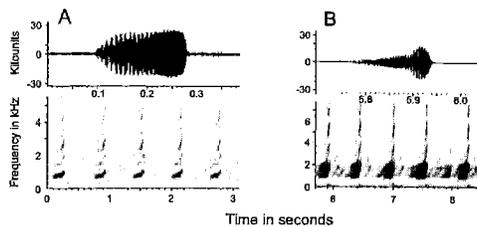


Figure 4. Wave form and audiospectrogram displays of the advertisement call of *Leptodactylus fragilis*. Wave form of first call in the audiospectrograms. A – USA, Texas, Hidalgo County, 2 miles east Madero, air temperature 28° C (Tape Station 29, Texas Memorial Museum recording). B – Venezuela, Estado de Zulia, Santa Barbara, air temperature 24° C (USNM recording 225, cut 2).

150 calls/min (Belize, Texas USA), 1.5–71 (Colombia), 104 (Costa Rica), 79 (Panama), and 86–93 (Venezuela). Call duration varies from 0.16–0.20 s, except the range from a Colombian population is 0.11–0.19 s. The call is amplitude modulated consisting of (a) either a single note of 22–25 pulses, (b) a single note with 9–10 pulses in the first half of the call with pulses becoming indistinct in the second half, or (c) two notes, the first note with 22–30 partial pulses, the second note either unpulsed or with 2–3 partial pulses. The call, a rising harsh whistle, is frequency modulated and either has a short drop in frequency at the very beginning and very end of the call (Panama) or rises throughout (Texas USA, Venezuela). The first part of the call (about 60–75% of total call duration) has a lower rate of frequency increase than the second part which has a rapid rise in frequency. The call begins at about 600–750 Hz (Texas USA), 810–940 Hz (Venezuela), 890–1020 Hz (Panama) or 1000 Hz (Belize, Costa Rica) and ends at about 1000–1200 Hz (Texas USA), 1700 Hz (Costa Rica), 1820–1920 Hz (Venezuela), 1970–2010 Hz (Belize, Panama), or 2200 Hz (Panama). Two patterns of intensity modulation occur in the available recordings. The first pattern except Texas USA) has a steady increase in energy during approximately the first 60% of the call, a rapid increase in energy ending at maximum loudness in about the next 25% of the call, and a rapid drop in loudness in approximately the final 15% of the call. The second pattern (Texas USA recording) has a fast rise of intensity during the first 25–33% of the call followed by steady or slight decrease of intensity during the next 20–30% a weak increase in the next 33%, a slow drop in the next 5–7% and a sharp drop of intensity in the final 5–7% of the call. The dominant frequency is the fundamental frequency and ranges from 740–780 Hz (Texas USA), 1720–1775 Hz (Venezuela), or 1865–1940 Hz (Panama). The call has a well-developed harmonic structure (see **Remarks**).

• **DIAGNOSIS.** The small species of *Leptodactylus* without distinct toe fringes, indistinct dorsolateral folds, a light longitudinal stripe on the lower portion of

the thigh, and obvious white tubercles on the dorsal surface of the shank and sole of the foot are *L. caatingae*, *fragilis*, and *latinasus*. There is considerable morphological overlap among these three species and they cannot be consistently diagnosed from each other based on morphological characters. The advertisement call of *L. fragilis* is longer (0.11–0.20 s) than the call of *L. caatingae* (0.07 s.). The advertisement call of *L. latinasus* is not pulsed (pulsed in *L. fragilis*) and the dominant frequency is higher (3000–3780 Hz) than that of *L. fragilis* (maximum 2200 Hz).

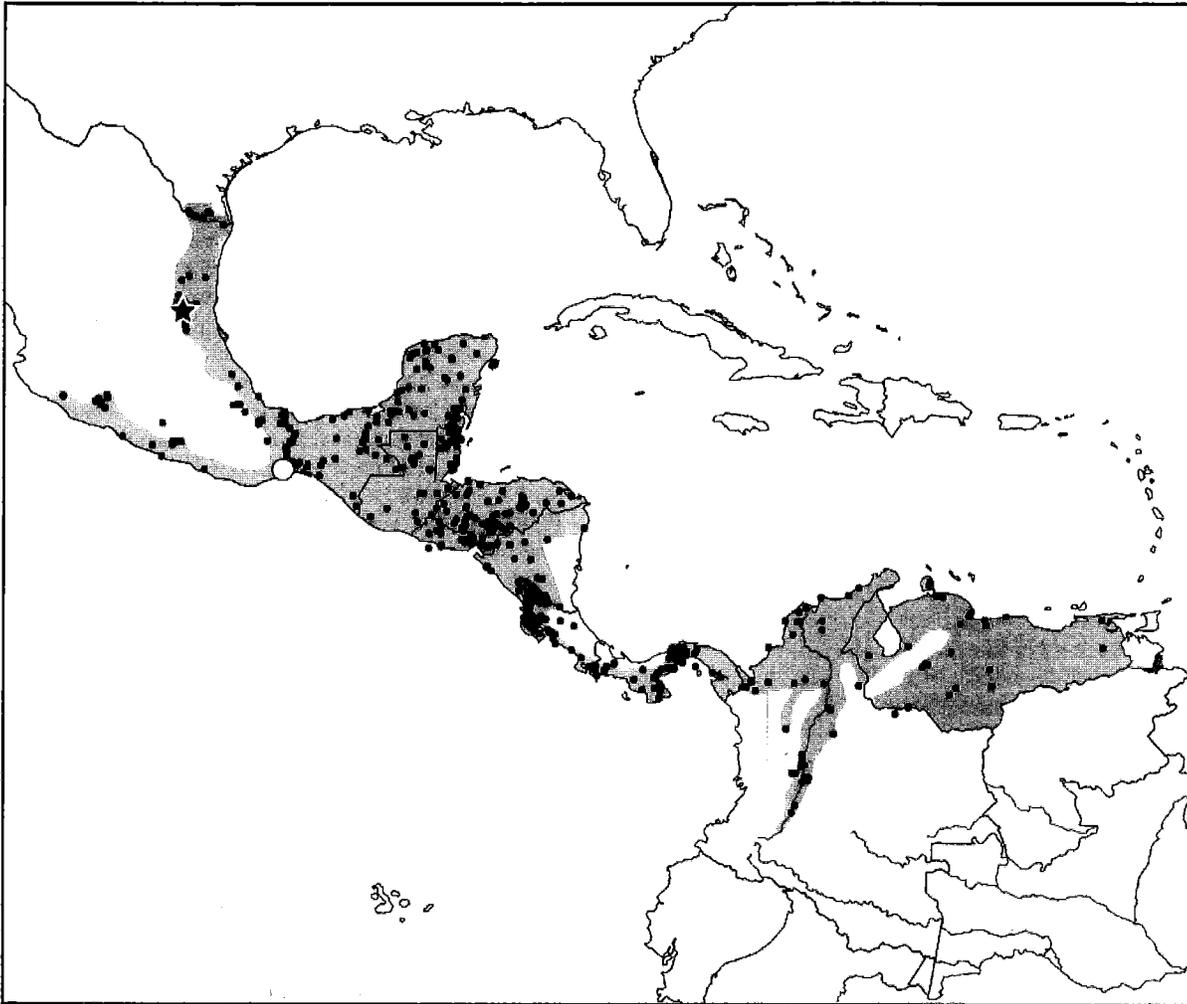
• **DESCRIPTIONS.** Brocchi's (1877) original description of the species included details of morphology and color. Additional descriptions of morphological characters and color may be found in Boulenger (1882), Brocchi (1882, as *L. labialis* and *L. caliginosus*, in part), Campbell (1998, as *L. labialis*), Günther (1900, as *L. fragilis* and *L. albilabris*, in part), Heyer (1970b, 1971, both as *L. labialis*, 1978, as *L. fragilis*), Ives (1892, as *L. labialis*), Kellogg (1932, as *L. albilabris*), Köhler et al. (2005, as *L. fragilis*), Lee (1996, 2000, as *L. labialis*), Maslin (1963b, as *L. labialis*), McCranie et al. (2006, as *L. fragilis*), McCranie and Wilson (2002, as *L. labialis*), Nieden (1923, as *L. fragilis*), Noble (1918, as *L. albilabris*), Rendón R. et al. (1998, as *L. labialis*), Ruthven (1912, as *L. albilabris*), Savage (2002, as *L. labialis*), Taylor (1932, as *L. albilabris*, 1954, as *L. labialis*), and Wright and Wright (1933, a secondary source as *L. albilabris*, in part). Larval characteristics and color are found in Campbell (1998, as *L. labialis*), Heyer (1970b, 1971, both as *L. labialis*, 1978, as *L. fragilis*), Lee (1996, 2000, as *L. labialis*), Maslin (1963a, as *L. labialis*), McCranie and Wilson (2002, as *L. labialis*), Mulaik (1937, as *L. labialis*), and Savage (2002, as *L. labialis*). Eggs of the species were described by Maslin (1963a, as *L. labialis*), while Maslin (1963b, as *L. labialis*) and Mulaik (1937, as *L. labialis*) characterized the foam nest. Descriptions of the advertisement call of *L. fragilis* are included in Fouquette (1960b, as *L. labialis*), Heyer (1971 as *L. labialis*), Lee (1996, as *L. labialis*), and Straughan and Heyer (1976, as *L. labialis*). Bogart (1974, as *L. labialis*) provided a description of the karyotype.

• **ILLUSTRATIONS.** Photographs of *L. fragilis* can be found in Bartlett (1999, as *L. labialis*), Bartlett and Bartlett (1999, as *L. labialis*), Behler and King (1979, as *L. labialis*), Bernal (2002, as *L. fragilis*), Bogart (1974, as *L. labialis*), Campbell (1998, as *L. labialis*), Conant (1991, as *L. labialis*), Cuentas Montalvo et al. (2002, as *L. labialis*), Freiberg (1972, as *L. labialis*), Garrett and Barker (1987, as *L. fragilis*), Heyer (1970b, as *L. labialis*), Höbel (2004b, as *L. labialis*), Ibáñez D. et al. (1999a, as *L. labialis*), Köhler (2001, as *L. labialis*), Köhler et al. (2005, as *L. fragilis*), Lee (1996, 2000, both as *L. labialis*), McCranie et al. (2006, as *L. fragilis*), McCranie and Wilson (2002, as *L. labialis*), Mertens (1952a, as *L. labialis*), Meyer and Foster (1996, as *L. labialis*), Mudde and van Dijk (1984, as *Rana pipiens*), Norman (1998, as *L. fragilis*), Renjifo and Lundberg (1999, as *L. fragilis*), Sa-

vage (2002, as *L. labialis*), Sennft (1935, as *L. labialis*), Taylor (1954, as *L. labialis*), Vences and Schmitt (1992, as *L. labialis*) and Weimer et al. (1993, as *L. fragilis*). Illustrations of adult specimens are included in the publications of Beletsky (1999, as *L. labialis*), Brocchi (1882, as *L. fragilis* and *L. caliginosus*), Conant (1958, 1975, both as *L. labialis*), Conant and Collins (1991, 1998, both as *L. labialis* and White-lipped [Frog]), Galindo-Leal (2003, as *L. labialis*), Gorzula and Señaris (1999, as *L. labialis*), Heyer (1978, as *L. fragilis*), Norman (1998, as *L. fragilis*), Smith (1978, as *L. labialis*), Wainwright (2000, as *L. fragilis*), Wright and Wright (1933, as *L. albilabris* in part, 1942, as *L. labialis* both secondary sources), Wright and Wright (1949, a secondary source as *L. labialis*), and Zim and Smith (1956, as *L. labialis*). Köhler (1999a, as *L. labialis*), Köhler et al. (2005, as *L. fragilis*), Lee (1996, 2000, as *L. labialis*), Powell et al. (1998, as *L. labialis*), Savage (2002, as *L. labialis*), and Villa (1972, as *L. labialis*) provided drawings of adult hands and feet, while Larson and de Sá (1998, as *L. labialis*) and Wever (1985, as *L. labialis*) illustrated larval chondrocranial characteristics and aspects of the ear, respectively. Larvae are illustrated in Conant and Collins (1998, as *L. labialis*), Heyer (1970b, as *L. labialis*), Köhler et al. (2005, as *L. fragilis*), Lee (1996, 2000, as *L. labialis*), Maslin (1963a, as *L. labialis*), Savage (2002, as *L. labialis*), and Villa (1972, as *L. labialis*). Dixon and Heyer (1968, as *L. labialis*), Höbel (2004b, as *L. labialis*), and Klingelhöffer and Scherpner (1956, as *L. labialis*) pictured foam nests of the species. Sonagrams or audiospectrograms or an oscilloscope trace appear in Bernal et al. (2004, as *L. fragilis*), Blair (1963, as *L. labialis*), Fouquette (1960b, as *L. labialis*), Heyer (1971, as *L. labialis*), Ibáñez D. et al. (1999a, as *L. labialis*), Kime et al. (2000, as *L. fragilis*), Lee (1996, as *L. labialis*), and Straughan and Heyer (1976, as *L. labialis*). Finally, Bogart (1974, as *L. labialis*) included a photograph of the karyotype.

• **DISTRIBUTION.** *Leptodactylus fragilis* is a lowland frog occurring from southernmost Texas (Cameron, Hidalgo, and Starr counties) on the Atlantic coast and Colima, Mexico on the Pacific coast, southward throughout Mexico and Middle America to northern Colombia including the Cauca and Magdalena valleys, the Río Arauca and Río Apure drainages in Colombia and northern Venezuela extending as far as the Venezuelan State of Sucre. The species has not been recorded from the mid-point of the Atlantic coastal lowlands of Costa Rica to the canal region in Panama, nor is it known from the islands of Margarita, Trinidad, or Tobago. Harding (1983, as *L. fragilis*) arranged its distribution by countries in the New World. Campbell (1999, as *L. labialis*) delineated its topographic and ecogeographic distribution in Middle America, while Duellman (1999, as *L. labialis*) tabulated its South American natural region distribution as Caribbean lowlands and Llanos. The species was reported as occurring between sea level and 1590 m.

The following references to distribution, localities and elevation (when provided) are listed by country



Map. Distribution of *Leptodactylus fragilis*. The type-locality is indicated by a circle. The purported fossil locality is indicated by a star. Dots mark other localities. A dot may represent more than one site. Published locality data used to generate the map should be considered as secondary sources of information, as we did not confirm identifications for all specimen localities. The locality coordinate data and sources are available on a spread-sheet at [http:// learning.richmond.edu/Leptodactylus](http://learning.richmond.edu/Leptodactylus).

and the letter (M) indicates species mention for a region with no precise locality data provided, while (S) denotes a secondary source: **Belize** (Campbell and Vannini 1989 [as *L. fragilis*], Fugler 1960 [as *L. labialis*], Henderson and Hoevers 1975 [as *L. labialis*], Heyer 1978 [as *L. fragilis*], Larson and de Sá 1998 [as *L. labialis*], Neill 1965 [as *L. labialis*], Neill and Allan 1961 [as *L. labialis*], Schmidt 1941 [as *L. labialis*], and Turvey and Cooper 1999 [as *L. labialis*]); **Colombia** (Acosta-Galvis 2000 [as *L. labialis*], Bernal et al. 2000 [as *L. fragilis*], Bogart 1974 [as *L. labialis*], Cuentas Montalvo et al. 2002 [as *L. labialis*], Heyer 1978 [as *L. fragilis*], Lynch and Suárez-Mayoraga 2004 [as *L. labialis*], Páez et al. 2002 [as *L. labialis*], Renjifo and Lundberg 1999 [as *L. fragilis*], and Ruiz-Carranza et al. 1996 [as *L. fragilis*]); **Costa Rica** (Albert et al. 2005 [as *L. labialis*], Fauth et al. 1989 [as *L. fragilis*], Heyer 1967, 1970b [both as *L. labialis*], 1978 [as *L. fragilis*], Hödl 1996 [as *L. labialis*], McDiarmid and Savage 2005 [as *L. labialis* (M)], Sasa and Solórzano 1995 [as *L. fragilis*], Savage 1973a,b

[both as *L. labialis*], 1980b [as *L. fragilis*], 2002 [as *L. labialis*], Savage and Villa 1986 [as *L. fragilis*], Scott et al. 1983 [as *L. fragilis*], Stafford 1998 [as *L. fragilis*], and Taylor 1952, 1954 [as *L. labialis*]); **El Salvador** (Heyer 1978 [as *L. fragilis*], Köhler et al. 2005 [as *L. fragilis*], Leenders and Watkins-Colwell 2004 [as *L. labialis*], Mertens 1952a,b [both as *L. labialis*], and Rand 1957 [as *L. labialis*]); **Guatemala** (Campbell 1998 [as *L. labialis*], Campbell and Vannini 1989 [as *L. fragilis*], Castañeda Moya et al. 2000 [as *L. labialis*], Crawford and Smith 2005 [as *L. labialis*], Duellman 1963 [as *L. labialis*], Heyer 1978 [as *L. fragilis*], Mendelson 1990 [as *L. fragilis*], Schmidt 1941 [as *L. labialis* (M)], and Stuart 1934, 1935, 1937, 1948, 1950, 1954, 1958, 1963 [all as *L. labialis*]); **Honduras** (Dunn and Emlen 1932 [as *L. labialis* and *L. melanotus* (sic) in part], Espinal et al. 2001 [as *L. labialis*], Heyer 1978 [as *L. fragilis*], Köhler 1999b [as *L. labialis*], Lynch and Fugler 1965 [as *L. labialis*], McCranie et al. 2002 [as *L. labialis*], McCranie et al. 2006 [as *L. fragilis*], McCranie and Wilson 2002 [as *L. labialis*],

- Meyer and Wilson 1971 [as *L. labialis* and *Scinax staufferi*, in part, {see McCranie and Wilson 2002, p. 325}], and Wilson et al. 1979, 1986 [both as *L. labialis*], 1991 [as *L. fragilis*]; **Mexico** (Anonymous 1998 [as *L. labialis*], Barbour 1914 [as *L. albilabris* (S)], Boulenger 1881 [as *L. albilabris* in part (M)(S)], 1882 [as *L. fragilis*], Brattstrom and Adis 1952 [as *L. labialis*], Brocchi 1877 [as *L. fragilis* and *L. caliginosus* in part], 1882 [as *L. fragilis*, *L. labialis* and *L. caliginosus* in part], Casas-Andreu et al. 1996 [as *L. labialis*], 2004 [as *L. fragilis*], Chrapliwy and Fugler 1955 [as *L. labialis*], Cope 1870 [as *Cystignathus gracilis*], 1879 [as *C. gracilis* and *C. labialis*], Davis and Dixon 1965 [as *L. labialis*], Davis and Smith 1953 [as *L. labialis*], Dixon and Heyer 1968 [as *L. labialis*], Duellman 1954, 1958a,b, 1960, 1961, 1965a,b [all as *L. labialis*], Dugès 1896 [as *L. labialis*], Dundee et al. 1986 [as *L. labialis*], Flores-Villela 1993a [as *L. labialis*], 1993b [as *L. cf. labialis-fragilis*], Flores-Villela et al. 1991 [as *L. labialis*], Gadow 1905, 1910 [both as *L. albilabris*], Gaige 1936 [as *L. labialis*], Goin 1959 [as *L. labialis*], Günther 1900 [as *L. albilabris*], 1902 [as *L. albilabris* in part], Hartweg and Oliver 1940 [as *L. labialis*], Heyer 1978 [as *L. fragilis*], Himmelstein 1981 [as *L. labialis*], Holman 1970, 2003 [both as *L. cf. L. labialis*], Ives 1892 [as *L. labialis*], Kellogg 1932 [as *L. albilabris*], Lazcano-Barrero et al. 1992 [as *L. fragilis*], Lee 1980, 1996, 2000 [all as *L. labialis*], Lerner 1992a,b [both as *L. labialis*], Lerner and Dundee 1969 [as *L. labialis*], Maldonado-Koerdell 1949, 1953 [both as *L. labialis*], Martin 1958 [as *L. labialis*], Martín del Campo 1953 [as *L. labialis*], Martínez Gracida 1891 [as *C. gracilis* and *C. labialis*], Maslin 1963a,b [both as *L. labialis*], Mata-López and León-Règagnon 2005 [as *L. labialis*], Müller 1884 [as *L. albilabris*], Pelcastre Villafuerte 1991 [as *L. labialis*], Pelcastre Villafuerte and Flores-Villela 1992 [as *L. labialis*], Pérez-Higareda et al. 1987 [as *L. fragilis*], Pineda and Halffter 2004 [as *L. labialis*], Pineda et al. 2005 [as *L. fragilis*], Pozo de la Tijera et al. 1991 [as *L. labialis*], Pyburn 1963, 1967 [both as *L. labialis*], Ramírez Granados and Guzmán del Prío 1963 [as *L. labialis* (M)], Reddell 1977, 1981 [both as *L. labialis*], Reese and Firschein 1950 [as *L. labialis*], Rendón R. et al. 1998 [as *L. labialis*], Ruthven 1912 [as *L. albilabris*], Schmidt and Shannon 1947 [as *L. labialis*], Schmitter-Soto et al. 2002 [as *L. labialis* (M)], Shreve 1957 [as *L. mystaceus labialis*], Smith 1938, 1947 [both as *L. labialis*], Smith and Smith 1976b [as *L. labialis*], Smith and Taylor 1948, 1966 [both as *L. labialis*], Smith and Darling 1952 [as *L. labialis*], Smith and Smith 1952 [as *L. labialis*], Starrett 1968 [as *L. labialis*], Stejneger and Barbour 1933 [as *L. albilabris*], 1939, 1943 [both as *L. labialis*], Stuart 1958 [as *L. labialis* (M)], Sumichrast 1880 [as *C. gracilis*], 1881 [as *C. labialis*], 1882a,b [both as *C. gracilis* and *C. labialis*], Taylor 1949, 1953 [both as *L. labialis*], Taylor and Smith 1945 [as *L. labialis*], Torres-Orozco et al. 2002 [as *L. labialis*], Urbina-Cardona and Reynoso 2005 [as *L. fragilis*], and Werler and Smith 1952 [as *L. labialis*]; **Nicaragua** (Heyer 1978 [as *L. fragilis*], Köhler 1999a, 2001 [both as *L. labialis*], Köhler et al. 2005 [as *L. fragilis*], Noble 1918 [as *L. albilabris*], Schmitt 1994 [as *L. labialis*], Vences and Schmitt 1992 [as *L. labialis*], and Villa 1972 [as *L. labialis*]); **Panama** (Bernal and Ron 2004 [as *L. fragilis*], Busack 1966 [as *L. labialis*], Dunn 1931, 1933a,b [all as *L. labialis*], Fouquette 1960a,b [both as *L. labialis*], Heyer 1978 [as *L. fragilis*], Ibáñez D. et al. 1995, 1997 [both as *L. labialis*], Martínez Cortés 1984 [as *L. fragilis*], Nemuras 1968 [as *L. labialis*], Ponssa 2004 [as *L. labialis*], Rand and Myers 1990 [as *L. labialis*], Summers 2002 [as *L. labialis*], Swanson 1945 [as *L. labialis*], Taylor 1952 [as *L. labialis* (S)], Tejera Nuñez and Dupuy Loo 1994 [as *L. fragilis*], 2003 [as *L. labialis*], Young et al. 1999 [as *L. labialis*], and Zweifel 1964 [as *L. labialis*]); **United States** (Bartlett 1999 [as *L. labialis*], Bartlett and Bartlett 1999 [as *L. labialis*], Blair 1957, 1968 [both as *L. labialis*], Brown 1950 [as *L. labialis*], Conant 1958, 1975 [both as *L. labialis*], Conant and Collins 1991, 1998 [both as *L. labialis*], Dixon 1987 [as *L. fragilis*], 2000 [as *L. labialis*], Fouquette 1960b [as *L. labialis*], Heyer 1978 [as *L. fragilis*], Livezey and Wright 1947 [as *L. labialis*], Mulaik 1937 [as *L. labialis*], Pratt 1935 [as *L. albilabris* (sic)], Raun and Gehlbach 1972 [as *L. labialis*], Schmidt 1953 [as *L. labialis*], Stejneger and Barbour 1933 [as *L. albilabris*], 1939, 1943 [both as *L. labialis*], Taylor 1932 [as *L. albilabris*], Travis et al. 1999 [as *L. labialis*], Wright and Wright 1933 [as *L. albilabris* in part], 1942 [as *L. labialis*], Wright 1935 [as *L. albilabris* in part], Wright and Wright 1938, 1949 [both as *L. labialis*], and Zim and Smith 1956 [as *L. labialis*]); **Venezuela** (Barrio-Amorós 1998 [as *L. labialis*], 2004 [as *L. fragilis*], Bisbal E. 1990 [as *L. fragilis*], Dixon and Staton 1976 [as *L. labialis*], Gorzula and Señaris 1999 [as *L. labialis*], Heyer 1978 [as *L. fragilis*], Hoogmoed and Gorzula 1979 [as *L. labialis*], La Marca 1992, 1995, 1997 [all as *L. labialis*], Mijares-Urrutia and Arends R. 2000 [as *L. labialis*], Öser 1934 [as *L. labialis*], Péfaur and Díaz de Pascual 1987 [as *L. fragilis*], Roca Perea 1982 [as *L. labialis*], and Staton and Dixon 1977 [as *L. labialis*]).
- **FOSSIL RECORD.** Hamblin (1984) noted a frog tibiofibula from Late Postclassic Cozumel Mayan excavations that could not be differentiated among *L. fragilis* (as *L. labialis*), *L. melanonotus*, or *Eleutherodactylus laticeps*. Holman (1970, as *L. cf. L. labialis*) tentatively assigned fossils of one left and two right ilia from the posterior parts of pelvic girdles (MU 8088) from the Pleistocene of Cueva de Abra, “. . . near the Pan American Highway, 10 kilometers north-northeast of the village of Antiguo Morelos, Tamaulipas, Mexico. . .” (p. 154) to this species. Carroll and Winer (1977, as *L. labialis*), Flores-Villela (1993a, as *L. cf. labialis-fragilis*), Holman (2003, as *L. cf. L. labialis*), and Sanchiz (1998, as *L. cf. labialis*) referred to the Tamaulipan fossils.
- **PERTINENT LITERATURE.** Heyer (1971 as *L. labialis*, 1978 as *L. fragilis*) published the most inclusive information on the species. The literature below is organized by topic. The symbol (M) after a citation stands for a mention of the species of interest only to a bibliophile and (S) indicates a secondary source:

bibliographic information and lists (Auth 1994 [as *L. labialis*], Beltz 1995 [as *L. fragilis*], Campbell 1999 [as *L. labialis*], Dixon 1993 [as *L. labialis*], Dixon and Liner 2003 [as *L. labialis*], La Marca 1992 [as *L. labialis*], Liner 1992c [as *L. labialis* in part], 1995, 1997, 1998, 1999 [all as *L. labialis*], Liner and Walley 1997 [as *L. labialis* in part], Péfaur 1992 [as *L. fragilis*], Savage 1980c [as *L. fragilis*], Savage and Villa 1986 [as *L. fragilis*], Smith and Smith 1973 [as *L. albilabris* and *L. labialis*], 1969, 1976b, 1993 [all as *L. labialis*], Taylor 1944 [as *L. albilabris*], 1947 [as *L. albilabris* and *L. labialis*], Travis et al. 1999 [as *L. labialis*], Villa 1983 [as *L. fragilis*], Villa et al. 1988 [as *L. fragilis*], and Walley 2000 [as *L. labialis*]); **biogeography** (Barrera 1963 [as *L. labialis*], Blair 1950 [as *L. labialis*], 1982 [as White-lipped Frog], Campbell 2001 [as *L. fragilis*], Cei 1962 [as *L. albilabris*], 1968 [as *L. labialis* (M)], Duellman 1954, 2001 [as *L. labialis*], Gadow 1930 [as *L. albilabris* (M)], Heyer 1978, 1988 [both as *L. fragilis*], Heyer and Maxson 1982 [as *L. fragilis* (M)], Johnson 1989, 1990 [both as *L. fragilis*], Lee 1980 [as *L. labialis*], Lynch and Suárez-Mayoraga 2004 [as *L. labialis*], Martin 1958 [as *L. labialis*], McCranie et al. 2006 [as *L. fragilis*], Mello Leitão 1947 [as *L. albilabris* (M)], Meyer and Meerman 2001 [as *L. labialis*], Müller 1973 [as *L. labialis*], Owen and Dixon 1989 [as *L. fragilis*], Péfaur and Rivero 2000 [as *L. labialis*], Ramírez-Bautista and Nieto Montes de Oca 1997 [as *L. labialis*], Rivero-Blanco and Dixon 1979 [as *L. fragilis*], Savage 2002 [as *L. labialis*], Smith and Buechner 1947 [as *L. labialis* (M)], Stuart 1950, 1954 [both as *L. labialis*], Wilson and McCranie 1998 [as *L. labialis*], and Wilson et al. 2001 [as *L. labialis*]); **book review** (Killebrew 1990 [as *L. fragilis*], and Lockington 1884 [as *L. fragilis*]); **call and call parameters** (Barrio 1965 [as *L. labialis* (S)], Bernal et al. 2004 [as *L. fragilis*], Bernal and Ron 2004 [as *L. fragilis*], Bevier 1995, 1997 [both as *L. labialis*], Blair 1963 [as *L. labialis* (M)], Campbell 1998 [as *L. labialis*], Dixon and Heyer 1968 [as *L. labialis*], Duellman 1960, 1967 [both as *L. labialis*], Duellman and Trueb 1966 [as *L. labialis*], Dunn 1933a,b [as *L. labialis*], Eggermont 1988 [as *L. labialis* (S)], Heyer 1978 [as *L. fragilis*], Kime et al. 2000 [as *L. fragilis*], Martin 1958 [as *L. labialis*], Mulaik 1937 [as *L. labialis*], Neill and Allan 1961 [as *L. labialis*], Öser 1934 [as *L. labialis*], Roca Perea 1982 [as *L. labialis*], Rose et al. 1988 [as *L. labialis*], Ryan 1985 [as *L. labialis*], Salthé and Mecham 1974 [as *L. labialis*], Savage 2002 [as *L. labialis*], Schmidt and Shannon 1947 [as *L. labialis*], Staton and Dixon 1977 [as *L. labialis*], Stuart 1948 [as *L. labialis*], Wells 2001 [as *L. labialis* (S)], Wilczynski et al. 2002 [as *L. labialis* (sic)], Wright and Wright 1933 [as *L. albilabris* in part (S)], 1942 [as *L. labialis* (S)], and Wright and Wright 1949 [as *L. labialis* (S)]; **captive breeding and care** (Klingelhöffer and Scherpner 1956 [as *L. labialis*], Öser 1934 [as *L. labialis*], and Sennft 1935 [as *L. labialis*]); **checklists** (Auth 1994 [as *L. labialis*], Brown 1950 [as *L. labialis*], Díaz de León 1904 [as *L. albilabris* and *L. fragilis*], Dowling 1975 [as *L. labialis*], Gorham 1974 [as *L. labialis*], Henderson and Hoovers 1975 [as *L. labialis*], Köhler 1999a [as *L. labialis*], Leenders 2001 [as *L. labialis*], McDiarmid 1987

[as *L. fragilis*], Meerman 1993 [as *L. labialis*], Meyer and Wilson 1971 [as *L. labialis*], Mijares-Urrutia and Arends R. 2000 [as *L. labialis*], Neill 1965 [as *L. labialis*], Péfaur 1992 [as *L. fragilis*], Péfaur and Rivero 2000 [as *L. labialis*], Pérez-Ramos et al. 2000 [as *L. labialis*], Pratt 1935 [as *L. alibilebris* (sic)], Schmidt 1953 [as *L. labialis*], Scott et al. 1983 [as *L. fragilis*], Señaris and MacCulloch 2005 [as *L. labialis*], Smith and Taylor 1948, 1966 [both as *L. labialis*], Stafford 1998 [as *L. fragilis*], Stejneger and Barbour 1933 [as *L. albilabris* in part], 1939, 1943 [both as *L. labialis*], Stuart 1963 [as *L. labialis*], Thomas 1974, 1976 [both as *L. labialis*], Villa 1971 [as *L. labialis*], 1983 [as *L. fragilis*], and Wilson 1983 [as *L. fragilis*]); **conservation** (Anonymous 1998 [as *L. labialis*], Ashton 1976 [as *L. labialis*], Bartlett and Bartlett 1999 [as *L. labialis*], Casas-Andreu et al. 1996 [as *L. labialis*], 2004 [as *L. fragilis*], Chaney 1982 [as *L. fragilis*], Coastal Impact Monitoring Program 1995 [as *L. fragilis*], Dixon 1987 [as *L. fragilis*], 2000 [as *L. labialis*], Donnelly and Crump 1998 [as *L. labialis*], Edwards et al. 1989 [as *L. fragilis*], Flores-Villuela (sic) 1980 [as *L. labialis*], García 2006, Garrett and Barker 1987 [as *L. fragilis*], González et al. 1999 [as *L. labialis*], Greenbaum and Komar 2005 [as *L. fragilis*], Heyer 2005 [as *L. fragilis*], Jiménez-Cruz et al. 1998 [as *L. labialis*], Köhler 2001 [as *L. labialis*], Lazcano-Barrero et al. 1992 [as *L. fragilis*], Levell 1995, 1997 [both as *L. labialis*], Lips et al. 2003 [as *L. labialis*], McCranie et al. 2006 [as *L. fragilis*], Meyer and Meerman 2001 [as *L. labialis*], Péfaur and Rivero 2000 [as *L. labialis*], Pineda and Halffter 2004 [as *L. labialis*], Pozo de la Tijera et al. 1991 [as *L. labialis*], Sánchez et al. 1999 [as *L. labialis*], Tejera Nuñez and Dupuy Loo 2003 [as *L. labialis*], Wilson and McCranie 2003 [as *L. labialis*], and Young et al. 1999 [as *L. labialis*], 2004 [as *L. fragilis*]); **development** (Mulaik 1937 [as *L. labialis*], Wright and Wright 1933 [as *L. albilabris* in part (S)], 1942 [as *L. labialis* (S)], and Wright and Wright 1949 [as *L. labialis* (S)]; **distribution** (Duellman and Sweet 1999 [as *L. labialis*], Iremonger et al. 1994 [as *L. fragilis*], Leenders 2003 [as *L. labialis* (M)], Limeses 1969 [as *L. labialis* (M)], and Wilson and Hahn 1973 [as *L. labialis*]); **ecology, natural history, reproduction** (Albert et al. 2005 [as *L. labialis*], Bernal and Ron 2004 [as *L. fragilis*], Blair 1976 [as *L. labialis*], Bogert 1969 [as *L. labialis* (M)(S)], Brattstrom and Adis 1952 [as *L. labialis*], Brazil and Vellard 1925 [as *L. fragilis* = *L. ?*], Campbell 1998 [as *L. labialis*], Campbell and Lamar 2004 [as *L. fragilis*], Conant 1955 [as *L. labialis*], Cuentas Montalvo et al. 2002 [as *L. labialis*], Davis 1951 [as *L. labialis*], Dixon and Heyer 1968 [as *L. labialis*], Duellman 1960, 1961, 1965b, 1966 [all as *L. labialis*], 1990 [as *L. fragilis*], Echternacht 1977 [as *L. labialis*], Espinal et al. 2001 [as *L. labialis*], Fauth et al. 1989 [as *L. fragilis*], Gadow 1901 [as *L. albilabris* in part (M)], Gorzula and Señaris 1999 [as *L. labialis*], Griffiths 1963 [as *L. labialis* (M)(S)], Heyer 1967, 1970b [both as *L. labialis*], Himmelstein 1981 [as *L. labialis*], Höbel 2004a,b [both as *L. labialis*], Ibáñez D. et al. 1997, 1999a [both as *L. labialis*], Ives 1892 [as *L. labialis*], Jameson 1955 [as *L. labialis*], Klingelhöffer and Scherpner 1956 [as *L. labialis*], La

- Marca and Garcia P. 1987 [as *L. fragilis*], Lescure 1972 [as *L. labialis* (M)(S)], Livezey and Wright 1947 [as *L. labialis*], Maslin 1963a [as *L. labialis*], McCoy and Censky 1992 [as *L. fragilis*], McCranie et al. 2006 [as *L. fragilis*], McDiarmid and Foster 1981 [as *L. fragilis*], Mulaik 1937 [as *L. labialis*], Neill and Allan 1961 [as *L. labialis*], Oliver 1955 [as *L. labialis*], Öser 1933 [as *L. labialis*], Péfaur and Díaz de Pascual 1987 [as *L. fragilis*], Philipbosian et al. 1974 [as *L. labialis* (S)], Pineda and Halffter 2004 [as *L. labialis*], Pineda et al. 2005 [as *L. fragilis*], Pocai 1941 [as *L. fragilis* = *L. ?* (S)], Ponssa 2004 [as *L. labialis*], Pyburn 1963 [as *L. labialis*], Ramirez et al. 1998 [as *L. labialis* (M)], Rand and Myers 1990 [as *L. labialis*], Reese and Firschein 1950 [as *L. labialis*], Roca Perea 1982 [as *L. labialis*], 1985 [as *L. fragilis*], Rossman 1963 [as *L. labialis*], Ruthven 1912 [as *L. albilabris*], Salthé and Mecham 1974 [as *L. labialis* (S)], Sasa and Solórzano 1995 [as *L. fragilis*], Savage 2002 [as *L. labialis*], Sazima 1975 [as *L. labialis* (S)], Schmitt 1994 [as *L. labialis*], Scott and Limerick 1983 [as *L. fragilis*], Seib 1984 [as *L. labialis*], Solano 1987 [as *L. fragilis* (S)], Solórzano 2004 [as *L. labialis*], Stuart 1935, 1950, 1954 [all as *L. labialis*], Torres-Orozco et al. 2002 [as *L. labialis* (S)], Urbina-Cardona and Reynoso 2005 [as *L. fragilis*], Vences and Schmitt 1992 [as *L. labialis*], Villa 1969a,b, 1970 [all as *L. labialis*], Vogt 1997 [as *L. labialis*], Wilczynski et al. 2002 [as *L. labialus* (sic)], Wright and Wright 1933 [as *L. albilabris* in part (S)], 1942 [as *L. labialis* (S)], Wright and Wright 1938, 1949 [both as *L. labialis* (S)], and Zweifel 1964 [as *L. labialis*]; **evolution** (Blair 1976 [as *L. labialis*], Heyer 1969a [as *L. labialis*], 1978 [as *L. fragilis*], and Roca Perea 1982 [as *L. labialis*]); **faunal accounts** (La Marca 1992 [as *L. labialis*], Meyer and Foster 1996 [as *L. labialis*]), and Sasa Marin 2000); **faunal lists** (Aranda and Guzmán 1999, Cope 1887 [as *L. gracilis* in part and *L. labialis*], Dugès 1896 [as *L. labialis*], Köhler 1999b [as *L. labialis*], and Pearse 1977 [as *L. labialis*]); **field guides** (Bartlett and Bartlett 1999 [as *L. labialis*], Behler and King 1979 [as *L. labialis*], Beletsky 1999 [as *L. labialis*], Cochran and Goin 1970 [as *L. labialis*], Conant 1958, 1975 [both as *L. labialis*], Conant and Collins 1991, 1998 [both as *L. labialis*], Cuentas Montalvo et al. 2002 [as *L. labialis*], Garrett and Barker 1987 [as *L. fragilis*], Lee 2000 [as *L. labialis*], Meyer and Foster 1996 [as *L. labialis*], Renjifo and Lundberg 1999 [as *L. fragilis*], Smith 1978 [as *L. labialis*], and Wainwright 2000 [as *L. fragilis*]); **habitat** (Augustine et al. 1998 [as *L. labialis*], Campbell 2001 [as *L. fragilis*], Cuentas Montalvo et al. 2002 [as *L. labialis*], Dixon and Heyer 1968 [as *L. labialis*], Duellman 1960, 1965b [both as *L. labialis*], 1990 [as *L. fragilis*], Espinal et al. 2001 [as *L. labialis*], Galindo-Leal 2003 [as *L. labialis*], Galindo-Leal et al. 2003 [as *L. labialis*], Goin et al. 1978 [as *L. labialis* (S)], Hartweg and Oliver 1940 [as *L. labialis*], Himmelstein 1981 [as *L. labialis*], Hödl 1996 [as *L. labialis*], Ibáñez D. et al. 1995, 1997 [both as *L. labialis*], Kellogg 1932 [as *L. albilabris* (S)], Lazcano-Barrero et al. 1992 [as *L. fragilis*], Lee 1996, 2000 [both as *L. labialis*], Leenders and Watkins-Colwell 2004 [as *L. labialis*], Martin 1958 [as *L. labialis*], McCranie et al. 2006 [as *L. fragilis*], Mendelson 1990 [as *L. fragilis*], Neill 1965 [as *L. labialis*], Neill and Allan 1961 [as *L. labialis*], Nemuras 1968 [as *L. labialis*], Pineda and Halffter 2004 [as *L. labialis*], Pineda et al. 2005 [as *L. fragilis*], Rand 1957 [as *L. labialis*], Reddell 1981 [as *L. labialis*], Rendón R. et al. 1998 [as *L. labialis*], Roca Perea 1982 [as *L. labialis*], Savage 2002 [as *L. labialis*], Schmidt and Shannon 1947 [as *L. labialis*], Schmitter-Soto et al. 2002 [as *L. labialis* (M)], Stafford 1998 [as *L. fragilis*], Stuart 1935, 1948 [both as *L. labialis*], Taylor 1932 [as *L. albilabris*], 1954 [as *L. labialis*], Tejera Nuñez and Dupuy Loo 2003 [as *L. labialis*], Urbina-Cardona and Reynoso 2005 [as *L. fragilis*], Vences and Schmitt 1992 [as *L. labialis*], Wright and Wright 1933 [as *L. albilabris* in part (S)], 1942 [as *L. labialis*], and Wright and Wright 1938, 1949 [both as *L. labialis* (S)]; **handbooks** (Wright and Wright 1933 [as *L. albilabris* in part], 1942 [as *L. labialis*], and Wright and Wright 1949 [as *L. labialis*]); **historical papers** (McDiarmid 1995 [as *L. labialis* (M)]); **inventories** (Bisbal 1990 [as *L. fragilis*], Ibáñez D. et al. 1995, 1997 [both as *L. labialis*], and Urbina-Cardona and Reynoso 2005 [as *L. fragilis*]); **karyotypes** (Bogart 1974 [as *L. labialis*], Gilboa 1975 [as *L. labialis* (S)], Heyer 1978 [as *L. fragilis* (S)], King 1990 [as *L. labialis* (S)], Kuramoto 1990 [as *L. fragilis* (S)], León 1970 [as *L. labialis*], Morescalchi 1979 [as *L. labialis*], Rada de Martínez 1976 [as *L. labialis*], and Savage 2002 [as *L. labialis* (S)]); **keys** (Altig 1970 [as *L. labialis*], 1987 [as *L. fragilis*], Ballinger and Lynch 1983 [as *L. fragilis*], Boulenger 1882 [as *L. fragilis*], Campbell 1998 [as *L. labialis*], Chaney 1982 [as *L. fragilis*], Cope 1879 [as *L. gracilis* and *L. labialis*], Cuentas Montalvo et al. 2002 [as *L. labialis*], Dixon 1987 [as *L. fragilis*], 2000 [as *L. labialis*], Dunn 1931 [as *L. labialis*], Flores-Villela et al. 1987 [as *L. fragilis*], Henderson and Hoervers 1975 [as *L. labialis*], Heyer 1970b [as *L. labialis*], 1978 [as *L. fragilis*], Köhler 1999a, 2001 [both as *L. labialis*], Köhler et al. 2005 [as *L. fragilis*], Lee 1996 [as *L. labialis*], Lips and Savage 1996 [as *L. labialis*], Livezey and Wright 1947 [as *L. labialis*], McCranie et al. 2006 [as *L. fragilis*], Mertens 1952a [as *L. labialis*], Meyer and Wilson 1971 [as *L. labialis*], Nemuras 1968 [as *L. labialis*], Nieden 1923 [as *L. fragilis*], Orton 1952 [as *L. labialis*], Powell et al. 1998 [as *L. labialis*], Savage 1980a, 1980c, 2002 [all as *L. labialis*], Savage and Villa 1986 [as *L. fragilis*], Smith 1978 [as *L. labialis*], Smith and Taylor 1948, 1966 [both as *L. labialis*], Stuart 1963 [as *L. labialis*], Sumichrast 1882b [as *L. gracilis* and *L. labialis* (S)], Villa 1972 [as *L. labialis*], Wilson and McCranie 1993 [as *L. labialis*], Wright and Wright 1933 [as *L. albilabris* in part], 1942 [as *L. labialis*], and Wright and Wright 1938, 1949 [both as *L. labialis*]); **lists of specimens in collections** (Auth et al. 2000 [as *L. labialis*], Flores-Villela et al. 1991 [as *L. labialis*], Müller 1884 [as *L. albilabris*], Tejera Nuñez and Dupuy Loo 1994 [as *L. fragilis*], and 2003 [as *L. labialis*]); **morphology** (Altig and Johnston 1986 [as *L. labialis*], Bevier 1995 [as *L. labialis*], Cardozo 2004 [as *L. labialis* (S)], Duellman 1961 [as *L. labialis*], Gaige 1936 [as *L. labialis*], Gans and Pyles 1983 [as *L. labialis*], Goin 1959 [as *L. labialis*], Haas 1996 [as

L. fragilis (S)); Hailman 1976 [as *L. labialis*], Helling 1938 [as *L. labialis*], Larson and de Sá 1998 [as *L. labialis*], Lee 1993 [as *L. labialis*], Martin 1972 [as *L. labialis*], Neill 1965 [as *L. labialis*], Neill and Allan 1961 [as *L. labialis*], Nussbaum 1982 [as *L. labialis*], Ponssa 2001 [as *L. labialis*], Roca Perea 1982 [as *L. labialis*], Starrett 1968 [as *L. labialis*], Villa 1972 [as *L. labialis*], Wever 1985 [as *L. labialis*], Wright and Wright 1933 [as *L. albilabris* in part (S)], 1942 [as *L. labialis* (S)], and Wright and Wright 1949 [as *L. labialis* (S)]; **nomenclature and taxonomy** (Bogert and Oliver 1945 [as *L. fragilis*], Crother et al. 2000 [as *L. labialis*], Dubois and Heyer 1992 [as *L. labialis*], Flores-Villela and Canseco-Márquez 2004 [as *L. fragilis*], Heyer 1971, 1974 [both as *L. labialis*], 2002 [as *L. fragilis*], Kellogg 1932 [as *L. albilabris*], Savage 2002 [as *L. labialis*], Schmidt 1928 [as *L. labialis* (M)], Smith 1987 [as *L. fragilis*], Smith and Smith 1976b [as *L. labialis*], and Taylor 1932 [as *L. albilabris*]); **non-technical literature** (Albert et al. 2005 [as *L. labialis*], Ballinger and Lynch 1983 [as *L. fragilis*], Bartlett 1999 [as *L. labialis*], Beletsky 1999 [as *L. labialis*], Bernal 2002 [as *L. fragilis*], Blair 1957, 1968 [both as *L. labialis*], Bruno 1969 [as *L. labialis*], Conant 1997 [as *L. labialis* (M)], Duellman 2003 [as *L. labialis*], Echternacht 1977 [as *L. labialis*], Flores-Villela and Hernández Gómez 1988 [as *L. labialis*], Frazer 1967a,b [both as *L. labialis*], Freiberg 1972 [as *L. labialis*], Freytag 1967 [as *L. labialis*], Galindo-Leal 2003 [as *L. labialis*], Krywicki 2001 [as *L. labialis*], Leviton 1971 [as *L. labialis*], Mohr 1963 [as *L. labialis*], Norman 1998 [as *L. fragilis*], Obst et al. 1984, 1988 [both as *L. labialis*], Smyth 1962 [as *L. labialis*], and Zim and Smith 1956 [as *L. labialis*]); **parasitology** (Earl 1974 [as *L. labialis*], Mata-López and León-Règagnon 2005 [as *L. labialis*], and Metcalf 1923 [as *L. albilabris* in part and *L. gracilis*]); **physiology** (Bevier 1995, 1997 [both as *L. labialis*], Brazil and Vellard 1926 [as *L. fragilis*], Hailman and Jaeger 1974 [as *L. labialis*], Jaeger and Hailman 1973 [as *L. labialis*], and Wells 2001 [as *L. labialis* (S)]); **relationships and systematics** (Barbour 1930, 1935 [both as *L. labialis* (M)], Barrio 1973 [as *L. labialis* (M)], Bogart 1974 [as *L. labialis*], Crawford and Smith 2005 [as *L. labialis*], Crother 1999 [as *L. labialis* (M)], Heyer 1978 [as *L. fragilis*], Heyer et al. 2005 [as *L. labialis*], Heyer and Diment 1974 [as *L. labialis*], Kluge and Farris 1969 [as *L. labialis*], Larson and de Sá 1998 [as *L. labialis*], Lynch 1971 [as *L. labialis*], Maxson and Heyer 1988 [as *L. fragilis*], Miyamoto 1981 [as *L. fragilis*], and Starrett 1968 [as *L. labialis*]); **species accounts** (Boulenger 1882 [as *L. fragilis*], Campbell 1998 [as *L. labialis*], Heyer 1970b, 1971 [both as *L. labialis*], 1978 [as *L. fragilis*], Ibáñez D. et al. 1999a [as *L. labialis*], Köhler et al. 2005 [as *L. fragilis*], Lee 1996, 2000 [both as *L. labialis*], McCranie et al. 2006 [as *L. fragilis*], McCranie and Wilson 2002 [as *L. labialis*], Meyer and Wilson 1971 [as *L. labialis*], Nieden 1923 [as *L. fragilis*], Savage 2002 [as *L. labialis*], Taylor 1954 [as *L. labialis*], Wright and Wright 1933 [as *L. albilabris* in part], 1942 [as *L. labialis*], and Wright and Wright 1949 [as *L. labialis*]); **species comparisons** (Barbour 1906 [as *L. fragilis* (M)], 1917, 1937 [both as *L.*

labialis (M)], Brocchi 1877 [as *C. fragilis*], Cascon and Peixoto 1985 [as *L. fragilis*], Cope 1894 [as *L. labialis*], Dunn 1940 [as *L. labialis*], Gaige 1936 [as *L. labialis*], Gallardo 1964 [as *L. labialis*], Heyer 1969b, 1970a,b, 1995 [all as *L. labialis*], 1978, 1983 [both as *L. fragilis*], Heyer et al. 2002 [as *L. fragilis*], Heyer and Heyer 2001 [as *L. labialis*], 2002 [as *L. fragilis*], Heyer and Juncá 2003 [as *L. fragilis*], Heyer and Thompson 2000 [as *L. labialis*], Larson and de Sá 1998 [as *L. labialis*], Orton 1951, 1952 [both as *L. labialis*], Savage 2002 [as *L. labialis*], Stejneger 1904 [as *L. albilabris*], Villa 1972 [as *L. labialis*], Weimer et al. 1993 [as *L. fragilis*], and Wettstein 1934 [as *L. albilabris*]); **specimens or taxonomic lists** (Acosta-Galvis 2000 [as *L. labialis*], Ananjeva et al. 1988 [as *L. fragilis*], Cochran 1961 [as *L. labialis*], Duellman 1993, 2003 [both as *L. labialis*], Dueñas et al. 2001 [as *L. labialis*], Flores-Villela 1993a [as *L. labialis*], Frost 1985 [as *L. fragilis*], Glaw et al. 2000 [as *L. labialis*], Gorham 1966 [as *L. labialis*], Guibé 1950 [as *L. fragilis*], Harding 1983 [as *L. fragilis*], Ibáñez D. et al. 2001 [as *L. labialis*], Köhler 2001 [as *L. labialis*], La Marca 1995, 1997 [both as *L. labialis*], Lazcano et al. 2006, Mertens 1952b [as *L. labialis*], Pérez et al. 2002 [as *L. labialis*], Ruiz-Carranza et al. 1996 [as *L. fragilis*], Smith and Smith 1976b [as *L. labialis*], Vogt et al. 1997 [as *L. labialis*], and Wilson and McCranie 1994 [as *L. labialis*]).

• **NOMENCLATURE HISTORY.** Both Brocchi (1877) and Cope (1877) penned species descriptions that were used by the scientific community for *L. fragilis* for various time periods. Dubois and Heyer (1992) demonstrated that *Cystignathus fragilis* Brocchi 1877 had publication date priority over *Cystignathus labialis* Cope 1877. During the early years of publications dealing with *L. fragilis*, some authors thought that the frogs from Mexico and Middle America belonged to the same species as *Leptodactylus gracilis*, a South American species. Up until the seminal work of Boulenger (1882), *L. fragilis* was variously cited as *L. fragilis*, *L. gracilis*, or *L. labialis* (or as a species of the genus *Cystignathus*, a synonym of the genus *Leptodactylus*). Boulenger recognized two species that involved what is currently understood as *L. fragilis*: *L. fragilis* (1882:241) and *L. albilabris* (1882:245). Boulenger thought that the supposedly Mexican species described by Cope (*C. labialis*) represented the same species described from St. Thomas in the West Indies as *Cystignathus albilabris* Günther. Stejneger (1904) concurred with Boulenger's synonymy and commented at some length on the zoogeographical implausibility of the same species occurring in Puerto Rico and Mexico, concluding on page 562: "In suggesting accidental introduction by man I am fully aware that this explanation does not at first appear plausible, as there does not seem to be or to have been any direct route of communication between southern Mexico or Yucatan and Porto Rico or the Virgin Islands, but I offer it as the only possibility I can think of. The wrecking of a vessel with a cargo of logwood or mahogany a hundred years or more ago might account for this remarkable distribution." Barbour (1914:252–253) did not accept this explanation

in his treatment of the zoogeography of the herpetofauna of the West Indies but thought the two species were similar because: "It is more probable that the Porto Rican and mainland individuals have by some fortuitous parallelism become indistinguishable if they originally belonged to different stocks ... (p. 253)." Schmidt (1928) in his treatment of the herpetofauna of Puerto Rico and the Virgin Islands strongly disagreed that *L. labialis* was conspecific with *L. albilabris* and described diagnostic characters that differentiated the two from one another. Dunn (e.g. 1931) treated the Middle American frogs as *L. labialis*. Kellogg (1932:84–87) recounted the taxonomic history of the species and, based on examination of specimens at his disposal, disagreed with Schmidt and concurred with Boulenger and Stejneger and recognized the Mexican frogs as *L. albilabris*. Taylor (1932) used *L. albilabris* in his paper reporting the species for the first time in the United States. Gaige (1936:291) examined preserved specimens, agreed with Dunn's assessment, and identified the frogs from the Yucatan of Mexico as *L. labialis*. Mulaik (1937) was the first to use *L. labialis* for the species in the United States, again based on examination of specimens from the USA and the West Indies. Thus, from the early through the late 1930's, the northern (USA and Mexico) frogs were mostly reported as *L. albilabris* and the southern frogs (Guatemala through Panama) as *L. labialis*. From the late 1930's until 1978, the species was reported as *L. labialis*. Heyer (1978:31–32) reported that the juvenile type specimens of *Cystignathus labialis* were conspecific with the South American species *Leptodactylus mystacinus*. Cope (1877) reported on specimens from Mexico, Costa Rica, Panama, and Argentina. The locality given by Cope (1877:90) for *C. labialis* was: "The precise habitat of this species is at present uncertain. It is probably a part of Sumichrast's Mexican collection." Heyer (1978) placed *Cystignathus labialis* into the synonymy of *Leptodactylus mystacinus* (Burmeister 1861) and recognized *Leptodactylus fragilis* as the appropriate name for the species that occurs from Texas to Venezuela. The saga should have ended here but took an unfortunate twist (to the embarrassment of one of the authors of this account). Dubois and Heyer (1992) ignored Heyer's (1978) action placing *C. labialis* in the synonymy of *L. mystacinus* and placed *C. fragilis* Brocchi 1877 in the synonymy of *L. labialis* (Cope 1877) based on when the respective papers were published. Throughout the 1980s until 2002, *Leptodactylus labialis* was the name used for the species involved. Heyer (2002), after re-reading Heyer (1978) and re-examining Cope's type specimens, pointed out the error in Dubois and Heyer (1992) and resurrected *Leptodactylus fragilis* (Brocchi 1877) as the appropriate name for the species.

• **REMARKS.** The following common names have been used for *Leptodactylus fragilis*: **Acacueyatl** (Martínez Gracida 1891 [as *L. gracilis* and *L. labialis*]); **American White-lipped Frog** (DuBois and Heyer 1992 [as *L. labialis*], Young et al. 2004 [as *L. fragilis*]); **Cope's White-lipped Frog** (Frank and Ramus

1995 [as *L. labialis*]); **Mexican White-lipped Frog** (Blair 1957, 1968 [both as *L. labialis*], Cochran and Goin 1970 [as *L. labialis*], Conant 1958 [as *L. labialis*], Conant et al. 1956 [as *L. labialis*], Crother et al. 2000 [as *L. labialis*], 2003 [as *L. fragilis*], Dowling 1975 [as *L. labialis*], Holman 2003 [as *L. cf. L. labialis*], Leviton 1971 [as *L. labialis*], McDiarmid 1987 [as *L. fragilis*], Obst et al. 1988 [as *L. labialis*], Oliver 1955 [as *L. labialis*], Raun and Gehlbach 1972 [as *L. labialis*], Schmidt 1953 [as *L. labialis*], Thomas 1974, 1976 [both as *L. labialis*]); **Pfeiffrosch** (Sennft 1935 [as *L. labialis*]); **Rana** (Martínez Gracida 1891 [as *L. gracilis* and *L. labialis*]); **Rana de Labios Blancos** (Flores-Villela and Hernández Gómez 1988 [as *L. labialis*]); **Rana de Dedos Delgados de Labios Blancos** (proposed common Spanish name at www.learning.richmond.edu/Leptodactylus [as *L. fragilis*]); **Ranilla** (Martínez Gracida 1891 [as *L. gracilis* and *L. labialis*]); **Ranita** (Lee 1996 [as *L. labialis*]); **Ranitade Charco** (Beletsky 1999 [as *L. labialis*], Galindo-Leal 2003 [as *L. labialis*], Limer 1994 [as *L. labialis*], Villa 1971 [as *L. labialis*], 1983 [as *L. fragilis*]); **Ranita de Charco Labio Blanco** (Köhler 2001 [as *L. labialis*]); **Ranita de Espumera de Labioblanco** (Campbell 1998 [as *L. labialis*], Galindo-Leal 2003 [as *L. labialis*]); **Ranita de Labios Blancos** (Freiberg 1972 [as *L. labialis*]); **Ranita de la Hojarasca** (Beletsky 1999 [as *L. labialis*], Galindo-Leal 2003 [as *L. labialis*], Lee 1996 [as *L. labialis*], Pozo de la Tijera et al. 1991 [as *L. labialis*]); **Ranita del Sabinal** (Galindo-Leal 2003 [as *L. labialis*]); **Rana Silbadora Labiblanca** (Norman 1998 [as *L. fragilis*], Wainwright 2000 [as *L. fragilis*]); **Sapo-Rana Sabiado** (Barrio-Amorós 1998 [as *L. labialis*]); **White-jawed Frog** (Wright and Wright 1933 [as *L. albilabris* in part], 1942 [as *L. labialis*], Wright and Wright 1949 [as *L. labialis*]); **White-jawed Robber Frog** (Wright and Wright 1942 [as *L. labialis*], Wright and Wright 1938, 1949 [both as *L. labialis*]); **White-lipped Foam Frog** (Bernal and Ron 2004 [as *L. fragilis*], Campbell 1998 [as *L. labialis*], Galindo-Leal 2003 [as *L. labialis*]); **White-lipped Frog** (Albert et al. 2005 [as *L. labialis*], Ashton 1976 [as *L. labialis*], Ballinger and Lynch 1983 [as *L. fragilis*], Bartlett 1999 [as *L. labialis*], Bartlett and Bartlett 1999 [as *L. labialis*], Behler and King 1979 [as *L. labialis*], Beletsky 1999 [as *L. labialis*], Blair 1982, Brown 1950 [as *L. labialis*], Chaney 1982 [as *L. fragilis*], Collins 1990, 1997 [both as *L. labialis*], Collins and Taggart 2002 [as *L. labialis*], Collins et al. 1978 [as *L. labialis*], 1979, 1982 [both as *L. fragilis*], Conant 1975, 1991, 1997 [all as *L. labialis*], Conant and Collins 1991, 1998 [both as *L. labialis*], Dixon 1987 [as *L. fragilis*], 1993, 2000 [both as *L. labialis*], Galindo-Leal 2003 [as *L. labialis*], Garrett and Barker 1987 [as *L. fragilis*], Krywicki 2001 [as *L. labialis*], Lee 1996, 2000 [both as *L. labialis*], Levell 1995, 1997 [both as *L. labialis*], Limer 1992b, 1994 [both as *L. labialis*], Meyer and Foster 1996 [as *L. labialis*], Stafford 1998 [as *L. fragilis*], Travis et al. 1999 [as *L. labialis*], Wright and Wright 1933 [as *L. albilabris* in part], 1942 [as *L. labialis*], Wright and Wright 1949 [as *L. labialis*], Zim and Smith 1956 [as *L. labialis*]); **White-lipped Thin-toed Frog** (proposed common English name at www.

learning.richmond.edu/*Leptodactylus* [as *L. fragilis*]; **White-lipped Toad** (Smith 1978 [as *L. labialis*]); **White-lipped Whistling Frog** (Norman 1998 [as *L. fragilis*], Wainwright 2000 [as *L. fragilis*]).

Volumes 3, 5, and 6 of Hobart and Rozella Smith's 'Synopsis of the Herpetofauna of Mexico' (1976a, 1977, and 1979) are included in this account because citations within them are referenced in later publications by these authors.

McCranie and Wilson (2002:444) do not state that tadpole tooth row P-1 is divided in *L. fragilis*. Their description is based on USNM 514731 (2 specimens in lot). Both specimens have the formula 2(2)/3(1), with the divided P-1 rows narrowly separated from each other. We suspect that other published citations of the formula 2(2)/3 (see Langone and de Sá 2005) also have narrowly separated P-1 rows and thus should be 2(2)/3(1).

The advertisement call description is based on published accounts by Bernal et al. (2004, as *L. fragilis* from Colombia); Fouquette (1960b, as *L. labialis* from Texas and Panama); Lee (1996, as *L. labialis* from Belize); Straughan and Heyer (1976, as *L. labialis* from Costa Rica) and analyses of calls from a Texas Memorial Museum recording (Tape Station 29) from Texas, Hidalgo County, 2 miles E Madero; the CD produced by Ibáñez D. et al. (1999b, as *L. labialis* from Panama); and USNM recording 225 cut 2 from Venezuela. The published information on advertisement calls did not contain information on all aspects of the call described in this account. Most available recordings lack information on air temperature at time of recording and size of the recorded male, thus the available information can not distinguish whether the observed variation in call parameters correlates with temperature, size of calling males, or populational variation.

• **ETYMOLOGY.** The name *fragilis*, meaning brittle, is derived from the Latin "frag", the root of "frango" (to break). It is unclear why the author used *fragilis* when naming this species.

• **ACKNOWLEDGMENTS.** James R. McCranie critically reviewed the manuscript. We thank the staffs of the Smithsonian Institution Libraries who obtained literature required to complete this account. Library staff include: Claire Catron, Maggie Dittmore, Carmen Eyzaguirre, Richard Greene, Polly Lasker, Ron Lindsey, Leslie Overstreet, Michael Richardson, Martha Rosen, Ruth Shallert, Courtney Shaw, David Steere, Wanda West, and Daría Wingreen-Mason. We also thank the following individuals for their help in providing information resolving problems with publication citations, localities, and identifications: César Barrio-Amorós, Manuel Bernal-Bautista, José Enrique Castillo, Roberto Ibáñez D., Twan Leenders, John D. Lynch, James R. McCranie, the late A. Stanley Rand, Alan Resetar, Gregory Schneider, and John Simmons. Travis LaDuc and Gregory Pauley provided a wave file of the Texas USA advertisement call recording. Research for this

account was supported by NSF award DEB-03429 to RdS and WRH.

LITERATURE CITED

- Acosta-Galvis, A.R. 2000. Ranas, salamandras y caecilias (Tetrapoda: Amphibia) de Colombia. *Biota Colombiana* 1:289–319.
- Albert, R., W. Hödl, W. Huber, M. Ringler, P. Weish, and A. Weissenhofer. 2005. The Amphibians & Reptiles of the Golfo Dulce Region Costa Rica: Corcovado National Park, Piedras Blancas National Park, "Regenwald der Österreicher." W. Huber & Weissenhofer, Vienna.
- Altig, R. 1970. A key to the tadpoles of the continental United States and Canada. *Herpetologica* 26: 180–207.
- . 1987. Key to the anuran tadpoles of Mexico. *The Southwestern Naturalist* 32:75–84.
- and G.F. Johnston. 1986. Major characteristics of free-living anuran tadpoles. *Smithsonian Herpetological Information Service* (67):1–75.
- Ananjeva, N., L.J. Borkin, I.S. Darevsky, and N.L. Orlov. 1988. Dictionary of Animal Names in Five Languages. Amphibians and Reptiles. Latin, Russian, English, German, French. 12126 Names. Russky Yaзык, Moscow.
- Anonymous. 1998. Programa de Manejo Parque Marino Nacional Arrecifes de Cozumel, Quintana Roo. Instituto Nacional de Ecología. México City.
- Aranda, M. and S. Guzmán. 1999. Listado faunístico de la Reserva de la Biosfera Calakmul, p. 163–176. *In* W.J. F. Higgins, M.C. Sanchez Gonzalez, and J.M. García Ortega (eds.), *Naturaleza y Cultura en Calakmul, Campeche*. CIHS, Universidad Autónoma de Campeche.
- Ashton Jr., R.E. 1976. Endangered and threatened amphibians and reptiles in the United States. *Society for the Study of Amphibians and Reptiles, Herpetological Circular* (5):v + 65 p.
- Augustine, J., C. Galindo-Leal, and B. Sandler. 1998. Habitat use and abundance of frogs in a slash-and-burn landscape mosaic in southeastern Campeche, Mexico, p. 82. *In* O. Herrera-MacBryde (ed.), *Maya Forest Biodiversity Workshop: Inventorying and Monitoring. Taller sobre Inventario y Monitoreo de Biodiversidad de la Selva Maya*. Flores, Petén, Guatemala, 29 September - 3 October 1997. SI/MAB: Measuring, Monitoring and Assessing Biodiversity Program, Smithsonian Institution, Washington, D.C.
- Auth, D.L. 1994. Checklist and bibliography of the amphibians and reptiles of Panama. *Smithsonian Herpetological Information Service* (98):1–59.
- , H.M. Smith, B.C. Brown, and D. Lintz. 2000. A description of the Mexican amphibian and reptile collection of the Strecker Museum. *Bulletin of the Chicago Herpetological Society* 35:65–85.
- Ballinger, R.E. and J.D. Lynch. 1983. *How to Know the Amphibians and Reptiles*. Wm. C. Brown Company, Dubuque, Iowa.
- Barbour, T. 1906. Vertebrata from the savanna of Panama. *Reptilia and Amphibia. Bulletin of the Mu-*

- seum of Comparative Zoology at Harvard College 46:224–229.
- . 1914. A contribution to the zoögeography of the West Indies, with especial reference to amphibians and reptiles. *Memoirs of the Museum of Comparative Zoology at Harvard College* 44:209–359 + 1 plate.
 - . 1917. Notes on the herpetology of the Virgin Islands. *Proceedings of the Biological Society of Washington* 30:97–103.
 - . 1930. A list of Antillean reptiles and amphibians. *Zoologica* 11:61–116.
 - . 1935. A second list of Antillean reptiles and amphibians. *Zoologica* 19:77–141.
 - . 1937. Third list of Antillean reptiles and amphibians. *Bulletin of the Museum of Comparative Zoology at Harvard College* 82:77–166.
- Barrera, A. 1963 ("1962"). La Península de Yucatán como provincia biótica. *Revista de la Sociedad Mexicana de Historia Natural* 23:71–105.
- Barrio, A. 1965. Afinidades del canto nupcial de las especies cavícolas del género *Leptodactylus* (Anura - Leptodactylidae). *Physis* 25:401–410.
- . 1973. *Leptodactylus geminus* una nueva especie del grupo *fuscus* (Anura, Leptodactylidae). *Physis* 32:199–206.
- Barrio-Amorós, C.L. 1998. Sistemática y biogeografía de los anfibios (Amphibia) de Venezuela. Systematics and biogeography of the amphibians (Amphibia) of Venezuela. *Acta Biológica Venezuelica* 18:1–93.
- . 2004. Amphibians of Venezuela systematic list, distribution and references, an update. *Revista de Ecología Latinoamericana* 9:1–48.
- Bartlett, R.D. 1999. Notes from the field: Bartlett vs. Texas, rounds 7 and 8. *Reptiles* 7:16–22.
- and P.P. Bartlett. 1999. *A Field Guide to Texas Reptiles and Amphibians*. Gulf Publishing Company, Houston, Texas.
- Behler, J.L. and F.W. King. 1979. *The Audubon Society Field Guide to North American Reptiles and Amphibians*. Alfred A. Knopf, Inc., New York.
- Beletsky, L. 1999. *Tropical Mexico. The Ecotravellers' Wildlife Guide Natural World*. Academic Press, San Diego, London, Boston, New York, Sydney, Tokyo, Toronto.
- Beltz, E. 1995. Citations for the original descriptions of North American amphibians and reptiles. *Society for the Study of Amphibians and Reptiles, Herpetological Circular* (24):vi + 44 p.
- Bernal, M.H. 2002. *Ranas y Sapos del Municipio de Ibagué*. Universidad del Tolima, Ibagué, Colombia.
- , D.A. Bejarano, J.M. Machado, D.P. Montealegre, and C.A. Páez. 2000. Estudio de la anurofauna del Municipio de Ibagué. *Acta Biológica Colombiana* 5:23–27.
 - , D.P. Montealegre, and C.A. Páez. 2004. Estudio de la vocalización de trece especies de anuros del municipio de Ibagué, Colombia. *Revista de la Academia Colombiana de Ciencias Exactas, Físicas y Naturales* 28:385–390.
- Bernal, X. and S.R. Ron. 2004. Natural history notes. *Leptodactylus fragilis* (White-lipped Foamfrog). *Courtship. Herpetological Review* 35:372–373.
- Bevier, C.R. 1995. Biochemical correlates of calling activity in Neotropical frogs. *Physiological Zoology* 68:1118–1142.
- . 1997. Utilization of energy substrates during calling activity in tropical frogs. *Behavioral Ecology and Sociobiology* 41:343–352.
- Bisbal E., F.J. 1990. Inventario preliminar de la fauna del Cerro Santa Ana, Península de Paraguana - Estado Falcón, Venezuela. *Acta Científica Venezolana* 41:177–185.
- Blair, A.P. 1957. Amphibians, p. 211–271. In W.F. Blair, A.P. Blair, P. Brodtkorb, F.R. Cagle, and G.A. Moore (eds.), *Vertebrates of the United States*. McGraw-Hill Book Company, Inc., New York, Toronto, London.
- . 1968. Amphibians, p. 167–212. In W.F. Blair, A.P. Blair, P. Brodtkorb, F.R. Cagle, and G.A. Moore (eds.), *Vertebrates of the United States. Second Edition*. McGraw-Hill Book Company, New York, St. Louis, San Francisco, Toronto, London, Sydney.
- Blair, W.F. 1950. The biotic provinces of Texas. *The Texas Journal of Science* 2:93–117.
- . 1963. Acoustic behaviour of Amphibia, p. 694–708, 803–804. In R.G. Busnel (ed.), *Acoustic Behaviour of Animals*. Elsevier Publishing Company, Amsterdam, London, New York.
 - . 1976. Adaptation of anurans to equivalent desert scrub of North and South America, p. 197–222. In D.W. Goodall (ed.), *Evolution of Desert Biota*. University of Texas Press, Austin, London.
 - . 1982. Biogeography and the anurans of Texas. *The Nature Conservancy News* 32:24–26.
- Bogart, J.P. 1974. A karyosystematic study of frogs in the genus *Leptodactylus* (Anura: Leptodactylidae). *Copeia* 1974:728–737.
- Bogert, C.M. 1969. The eggs and hatchlings of the Mexican leptodactylid frog *Eleutherodactylus decoratus* Taylor. *American Museum Novitates* (2376):1–9.
- and J.A. Oliver. 1945. A preliminary analysis of the herpetofauna of Sonora. *Bulletin of the American Museum of Natural History* 83:297–426 + Plates 30–37.
- Boulenger, G.A. 1881. *Leptodactylus caliginosus* Girard et *L. albilabris* Günther. *Bulletin de la Société Zoologique de France* 6:30–35.
- . 1882. Catalogue of the Batrachia Salientia s. Ecaudata in the Collection of the British Museum. Second Edition. Trustees of the British Museum, London.
- Brattstrom, B.H. and N.B. Adis. 1952. Notes on a collection of reptiles and amphibians from Oaxaca, Mexico. *Herpetologica* 8:59–60.
- Brazil, V. and J. Vellard. 1925. Contribuição ao estudo do veneno das aranhas – aranhas inimigas das serpentes. – Genero *Grammostola*. *Brazil-Medico* 39:47–51.
- and –. 1926. Contribuição ao estudo dos batrachios. *Memórias do Instituto Butantan* 3:7–70 + Plates 1–9.

- Brocchi, M.P. 1877. Sur quelques batraciens raniformes et bufoniformes de l'Amérique Centrale. Bulletin de la Société Philomathique de Paris Series 7, 1:175-197.
- . 1882. Étude des Batraciens de l'Amérique Centrale. Imprimerie Nationale, Paris.
- Brown, B.C. 1950. An Annotated Check List of the Reptiles and Amphibians of Texas. Baylor University, Waco, Texas.
- Bruno, S. 1969. Anfibi e Rettili, p. 131-224. In Enciclopedia Italiana delle Scienze, Vol. I, fasc. 71, 72, 73. Istituto Geografico de Agostini, Novara.
- Busack, S.D. 1966. Notes on a herpetological collection from the Azuero Peninsula, Panama. Copeia 1966:371.
- Campbell, J.A. 1998. Amphibians and Reptiles of Northern Guatemala, the Yucatán, and Belize. University of Oklahoma Press, Norman.
- . 1999. Distribution patterns of amphibians in Middle America, p. 111-210. In W.E. Duellman (ed.), Patterns of Distribution of Amphibians. A Global Perspective. The Johns Hopkins University Press, Baltimore, London.
- . 2001. The herpetofauna of the mesic upland forests of the Sierra de Las Minas and Montañas del Mico of Guatemala, p. 80-92. In J.D. Johnson, R.G. Webb, and O.A. Flores-Villela (eds.), Mesoamerican Herpetology: Systematics, Zoogeography, and Conservation. Centennial Museum, The University of Texas at El Paso, Special Publication (1).
- and W.W. Lamar. 2004. The Venomous Reptiles of the Western Hemisphere. Volume I. Comstock Publishing Associates, Ithaca, New York & London.
- and J.P. Vannini. 1989. Distribution of amphibians and reptiles in Guatemala and Belize. Proceedings of the Western Foundation of Vertebrate Zoology 4:1-21.
- Cardozo, O.M. 2004. Cambios Morfológicos Externos y del Cráneo Durante la Metamorfosis de *Leptodactylus mystacinus* (Anura: Leptodactylidae). Licenciado en Ciencias Biológicas, Universidad Nacional de Salta, Salta, Argentina.
- Carroll, R.L. and L. Winer. 1977. Appendix to accompany chapter 13. Patterns of amphibian evolution: An extended example of the incompleteness of the fossil record, p. 1-13. In A. Hallam (ed.), Patterns of Evolution as Illustrated by the Fossil Record, Vol. 5. Elsevier Scientific Publishing Company, Amsterdam, Oxford, New York.
- Casas-Andreu, G., F.R. Méndez-de la Cruz, and X. Aguilar-Miguel. 2004. Anfibios y reptiles, p. 375-390. In A.J. García-Mendoza, M.J. Ordóñez, and M. Briones-Salas (eds.), Biodiversidad de Oaxaca. Instituto de Biología, UNAM - Fondo Oaxaqueño para la Conservación de la Naturaleza - World Wildlife Fund, México, México.
- , -, and J.L. Camarillo Rangel. 1996. Anfibios y reptiles de Oaxaca. Lista, distribución y conservación. Acta Zoologica Mexicana (n.s.) 69:1-35.
- Cascon, P. and O.L. Peixoto. 1985. Observações sobre a larva de *Leptodactylus troglodytes* A. Lutz, 1926 (Amphibia, Anura, Leptodactylidae). Revista Brasileira de Biologia 45:361-364.
- Castañeda Moya, F., O. Lara, and A. Queral-Regil. 2000. Appendix 12. Amphibian and reptile species of Laguna del Tigre National Park, Petén, Guatemala. Apéndice 12. Especies de anfibios y reptiles del Parque Nacional Laguna del Tigre, Petén, Guatemala, p. 215-216. In B.T. Bestelmeyer, and L.E. Alonso (eds.), A Biological Assessment of Laguna del Tigre National Park, Petén, Guatemala. Evaluación Biológica de los Sistemas Acuáticos del Parque Nacional Laguna del Tigre, Petén, Guatemala, Vol. 16. Conservation International, Washington, D. C.
- Cei, J.M. 1962. Relations biogéographiques et phylogénétiques chez les amphibiens. Scientia 56, Sixième Série:1-8.
- . 1968. Distribution et spécialisation des batraciens sudaméricains, p. 199-214. In C. Delamare Deboutteville and E. Rapoport (eds.), Biologie de l'Amérique Australe, Volume IV. Documents Biogéographiques et Écologiques, Vol. IV. Éditions du Centre National de la Recherche Scientifique, Paris.
- Chaney, A.H. 1982. Keys to the Vertebrates of Texas. Caesar Kleberg Wildlife Research Institute, Kingsville, Texas.
- Chrapliwy, P.S. and C.M. Fugler. 1955. Amphibians and reptiles collected in Mexico in the summer of 1953. Herpetologica 11:121-128.
- Coastal Impact Monitoring Program. 1995. Report of Literature Review on Discharges from the Rio Grande and Arroyo Colorado and Their Impacts. Texas General Land Office, Austin.
- Cochran, D.M. 1961. Type specimens of reptiles and amphibians in the U.S. National Museum. Bulletin of the United States National Museum (220):xv + 291 p.
- and C.J. Goin. 1970. The New Field Book of Reptiles and Amphibians. G. P. Putnam's Sons, New York.
- Collins, J.T. 1990. Standard common and current scientific names for North American amphibians and reptiles. Society for the Study of Amphibians and Reptiles, Herpetological Circular (19):iii + 41 p.
- . 1997. Standard common and current scientific names for North American amphibians and reptiles. Fourth edition. Society for the Study of Amphibians and Reptiles, Herpetological Circular (25):iv + 40 p.
- , R. Conant, J.E. Huheey, J.L. Knight, E.M. Rundquist, and H.M. Smith. 1982. Standard common and current scientific names for North American amphibians and reptiles. Second edition. Society for the Study of Amphibians and Reptiles, Herpetological Circular (12):iv + 28 p.
- , J.E. Huheey, J.L. Knight, E.M. Rundquist, and H.M. Smith. 1979. Report of the SSAR Committee on Common and Scientific Names for 1979. Herpetological Review 10:109-110.
- , -, and H.M. Smith. 1978. Standard common and current scientific names for North American amphibians and reptiles. Society for the Study of Am-

- phibians and Reptiles, Herpetological Circular (7): iii + 36 p.
- and T.W. Taggart. 2002. Standard Common and Current Scientific Names for North American Amphibians, Turtles, Reptiles & Crocodylians. Fifth Edition. The Center for North American Herpetology, Lawrence, Kansas.
- Conant, R. 1955. Notes on three Texas reptiles, including an addition to the fauna of the state. *American Museum Novitates* (1726):1–6.
- . 1958. *A Field Guide to Reptiles and Amphibians of the United States and Canada East of the 100th Meridian* Houghton Mifflin Company, Boston.
- . 1975. *A Field Guide to Reptiles and Amphibians of Eastern and Central North America*. Second Edition. Houghton Mifflin Company, Boston.
- . 1991. Attempting the impossible - III. *Bulletin of the Chicago Herpetological Society* 26:213–220.
- . 1997. *A Field Guide to the Life and Times of Roger Conant*. Selva, Canyonlands Publishing Group, L.C., Provo, Utah.
- , F.R. Cagle, C.J. Goin, C.H. Lowe Jr., W.T. Neill, M.G. Netting, K.P. Schmidt, C.E. Shaw, R.C. Stebbins, and C.M. Bogert. 1956. Common Names for North American amphibians and reptiles. *Copeia* 1956:172–185.
- and J.T. Collins. 1991. *A Field Guide to Reptiles and Amphibians: Eastern and Central North America*. Third Edition. Houghton Mifflin Company, Boston, New York.
- and –. 1998. *A Field Guide to Reptiles & Amphibians: Eastern and Central North America*. Third Edition, Expanded. Houghton Mifflin Company, Boston, New York.
- Cope, E.D. 1870 ("1869"). Seventh contribution to the herpetology of tropical America. *Proceedings of the American Philosophical Society* 11:147–169 + 3 Plates.
- . 1877. Tenth contribution to the herpetology of tropical America. *Proceedings of the American Philosophical Society* 17:85–98.
- . 1879. Eleventh contribution to the herpetology of tropical America. *Proceedings of the American Philosophical Society* 18:261–277.
- . 1887. Catalogue of the batrachians and reptiles of Central America and Mexico. *Bulletin of the United States National Museum* (32):1–98.
- . 1894 ("1893"). Second addition to the knowledge of the Batrachia and Reptilia of Costa Rica. *Proceedings of the American Philosophical Society* 31:333–347.
- Crawford, A.J. and E.N. Smith. 2005. Cenozoic biogeography and evolution in direct-developing frogs of Central America (Leptodactylidae: *Eleutherodactylus*) as inferred from a phylogenetic analysis of nuclear and mitochondrial genes. *Molecular Phylogenetics and Evolution* 35:536–555.
- Crother, B.I. 1999. Evolutionary relationships, p. 269–334. *In* B.I. Crother (ed.), *Caribbean Amphibians and Reptiles*. Academic Press, San Diego, London, Boston, New York, Sydney, Tokyo, Toronto.
- , J. Boundy, J.A. Campbell, K. de Queiroz, D.R. Frost, R. Highton, J.B. Iverson, P.A. Meylan, T.W. Reeder, M.E. Seidel, J.W. Sites Jr., T.W. Taggart, S.G. Tilley, and D.B. Wake. 2000. Scientific and standard English names of amphibians and reptiles of North America north of Mexico, with comments regarding confidence in our understanding. *Society for the Study of Amphibians and Reptiles, Herpetological Circular* (29):iii + 82 p.
- , –, –, –, –, D.M. Green, R. Highton, J.B. Iverson, R.W. McDiarmid, P.A. Meylan, T.W. Reeder, M.E. Seidel, J.W. Sites Jr., S.G. Tilley, and D.B. Wake. 2003. Scientific and standard English names of amphibians and reptiles of North America north of Mexico: update. *Herpetological Review* 34:196–203.
- Cuentas Montalvo, D., R. Borja Acuña, J.D. Lynch, and J.M. Rengifo [sic]. 2002. Anuros del Departamento del Atlántico y Norte de Bolívar. *Cencys* 21, Barranquilla (Colombia).
- Davis, W.B. 1951. Food of the black-banded snake, *Coniophanes imperialis imperialis* Baird. *Copeia* 1951:314.
- Davis, W.B. and J.R. Dixon. 1965. Amphibians of the Chilpancingo region, México. *Herpetologica* 20: 225–233.
- and H.M. Smith. 1953. Amphibians of the Mexican State of Morelos. *Herpetologica* 8:144–149.
- Díaz de León, J. 1904. *Indice de los Batracios Que se Encuentran en la República Mexicana*. Imprenta de Ricardo Rodríguez Romo, Aguascalientes.
- Dixon, J.R. 1987. *Amphibians and Reptiles of Texas with Keys, Taxonomic Synopses, Bibliography, and Distribution Maps*. Texas A&M University Press, College Station, Texas.
- . 1993. Supplement to the literature for the "Amphibians and Reptiles of Texas" 1987. *Smithsonian Herpetological Information Service* (94):1–43.
- . 2000. *Amphibians and Reptiles of Texas*. Second Edition. With Keys, Taxonomic Synopses, Bibliography, and Distribution Maps. Texas A&M University Press, College Station, Texas.
- and W.R. Heyer. 1968. Anuran succession in a temporary pond in Colima, Mexico. *Bulletin of the Southern California Academy of Sciences* 67: 129–137.
- and E.A. Liner. 2003. Herpetological papers published in *Anales del Instituto [sic] de Biología de la Universidad Nacional Autónoma de México*. *Boletín de la Sociedad Herpetológica Mexicana* 11:57–74.
- and M.A. Staton. 1976. Some aspects of the biology of *Leptodactylus macrosternum* Miranda-Ribeiro (Anura: Leptodactylidae) of the Venezuelan Llanos. *Herpetologica* 32:227–232.
- Donnelly, M.A. and M.L. Crump. 1998. Potential effects of climate change on two neotropical amphibian assemblages. *Climatic Change* 39:541–561.
- Dowling, H.G. 1975 [1974]. A classification and checklist of the species of amphibians and reptiles found in the United States and Canada, p. 175–189. *In* H.G. Dowling (ed.), *Yearbook of Herpetology*, Vol. 1. *Herpetological Information*

- Search Systems, The American Museum of Natural History, New York.
- Dubois, A. and W.R. Heyer. 1992. *Leptodactylus labialis*, the valid name for the American white-lipped frog (Amphibia: Leptodactylidae). *Copeia* 1992: 584–585.
- Duellman, W.E. 1954. The amphibians and reptiles of Jorullo Volcano, Michoacán, Mexico. Occasional Papers of the Museum of Zoology, University of Michigan (560):1–24 + 2 plates.
- . 1958a. Comments on the type locality and geographical distribution of *Urosaurus gadowi*. *Copeia* 1958:48–49.
- . 1958b. A preliminary analysis of the herpetofauna of Colima, México. Occasional Papers of the Museum of Zoology, University of Michigan (589):1–22.
- . 1960. A distributional study of the amphibians of the Isthmus of Tehuantepec, México. University of Kansas Publications, Museum of Natural History 13:19–72.
- . 1961. The amphibians and reptiles of Michoacán, México. University of Kansas Publications, Museum of Natural History 15:1–148 + 6 plates.
- . 1963. Amphibians and reptiles of the rainforests of southern El Petén, Guatemala. University of Kansas Publications, Museum of Natural History 15: 205–249 + 4 plates.
- . 1965a. Amphibians and reptiles from the Yucatán Peninsula, México. University of Kansas Publications, Museum of Natural History 15:577–614.
- . 1965b. A biogeographic account of the herpetofauna of Michoacán, México. University of Kansas Publications, Museum of Natural History 15:627–709 + 8 plates.
- . 1966. The Central American herpetofauna: an ecological perspective. *Copeia* 1966:700–719.
- . 1967. Social organization in the mating calls of some neotropical anurans. *The American Midland Naturalist* 77:156–163.
- . 1990. Herpetofaunas in neotropical rainforests: comparative composition, history, and resource use, p. 455–505. In A.H. Gentry (ed.), *Four Neotropical Rainforests*. Yale University Press, New Haven, London.
- . 1993. Amphibian species of the world: additions and corrections. University of Kansas Museum of Natural History, Special Publication (21):iii + 372 p.
- . 1999. Distribution patterns of amphibians in South America, p. 255–328. In W.E. Duellman (ed.), *Patterns of Distribution of Amphibians. A Global Perspective*. The Johns Hopkins University Press, Baltimore, London.
- . 2001. The hylid frogs of Middle America. Volume 2. Society for the Study of Amphibians and Reptiles, Contributions to Herpetology (18):x + 695–1159 + 92 plates.
- (Compiler). 2003. Amphibians species list, p. 456–489. In M. Hutchins, W.E. Duellman, and N. Schlager (eds.), *Grzimek's Animal Life Encyclopedia*. Second Edition. Volume 6, Amphibians. Gale Group, Farmington Hills, Michigan.
- and S.S. Sweet. 1999. Distribution patterns of amphibians in the Nearctic region of North America, p. 31–109. In W.E. Duellman, (ed.), *Patterns of Distribution of Amphibians. A Global Perspective*. The Johns Hopkins University Press, Baltimore, London.
- and L. Trueb. 1966. Neotropical hylid frogs, genus *Smilisca*. University of Kansas Publications, Museum of Natural History 17:281–375 + 12 plates.
- Dueñas, C., L.D. Wilson, and J.R. McCranie. 2001. A list of the amphibians and reptiles of El Salvador, with notes on additions and deletions, p. 93–99. In J.D. Johnson, R.G. Webb, and O.A. Flores-Villela (eds.), *Mesoamerican Herpetology: Systematics, Zoogeography, and Conservation*. Centennial Museum, The University of Texas at El Paso, Special Publication (1).
- Dugès, A. 1896 [1897]. Reptiles y batracios de los E.U. Mexicanos. *La Naturaleza, Periódico Científico de la Sociedad Mexicana de Historia Natural, Segunda Serie* 2:479–485.
- Dundee, H.A., D.A. White, and V. Rico-Gray. 1986. Observations on the distribution and biology of some Yucatán amphibians and reptiles. *Bulletin Maryland Herpetological Society* 22:37–50.
- Dunn, E.R. 1931. The amphibians of Barro Colorado Island. Occasional Papers of the Boston Society of Natural History 5:403–421.
- . 1933a. A new *Hyla* from the Panama Canal Zone. Occasional Papers of the Boston Society of Natural History 8:61–64.
- . 1933b. Amphibians and reptiles from El Valle de Anton, Panama. Occasional Papers of the Boston Society of Natural History 8:65–79.
- . 1940. New and noteworthy herpetological material from Panama. *Proceedings of the Academy of Natural Sciences of Philadelphia* 92:105–122 + 1 plate.
- and J.T. Emlen, Jr. 1932. Reptiles and amphibians from Honduras. *Proceedings of the Academy of Natural Sciences of Philadelphia* 84:21–32.
- Earl, P.R. 1974. Protozoan endosymbionts of Amphibia in the Greater Antilles and Florida. *Zoologischen Anzeiger, Jena* 193:262–265.
- Echternacht, A.C. 1977. *How Reptiles and Amphibians Live*. Elsevier Phaidon, Oxford.
- Edwards, R.J., G. Longley, R. Moss, J. Ward, R. Matthews, and B. Stewart. 1989. A classification of Texas aquatic communities with special consideration toward the conservation of endangered and threatened taxa. *The Texas Journal of Science* 41:231–240.
- Eggermont, J.J. 1988. Mechanisms of sound localization in anurans, p. 307–336. In B. Fritzsche, M.J. Ryan, W. Wilczynski, T.E. Hetherington, and W. Walkowiak (eds.), *The Evolution of the Amphibian Auditory System*. John Wiley & Sons, New York, Chichester, Brisbane, Toronto, Singapore.
- Espinal, M.R., J.R. McCranie, and L.D. Wilson. 2001. The herpetofauna of Parque Nacional La Muralla, Honduras, p. 100–108. In J.D. Johnson, R.G. Webb, and O.A. Flores-Villela (eds.), *Mesoamerican Herpetology: Systematics, Zoogeography,*

- and Conservation. Centennial Museum, The University of Texas at El Paso, Special Publication (1).
- Fauth, J.E., B.I. Crother, and J.B. Slowinski. 1989. Elevational patterns of species richness, evenness, and abundance of the Costa Rican leaf-litter herpetofauna. *Biotropica* 21:178–185.
- Flores-Villela, O.A. 1980 [1978]. Contribución al conocimiento de los anfibios y reptiles de importancia económica. *Memorias II Congreso Nacional de Zoología, Monterrey, Nuevo León, 6 al 9 de Diciembre de 1978* 1:343–356.
- . 1993a. Herpetofauna of Mexico: distribution and endemism, p. 253–280. *In* T.P. Ramamoorthy, R. Bye, A. Lot, and J. Fa (eds.), *Biological Diversity of Mexico: Origins and Distribution*. Oxford University Press, New York, Oxford.
- . 1993b. Herpetofauna Mexicana. Lista anotada de las especies de anfibios y reptiles de México, cambios taxonómicos recientes, y nuevas especies. Annotated list of the species of amphibians and reptiles of Mexico, recent taxonomic changes, and new species. *Carnegie Museum of Natural History, Special Publication (17):iv + 1–73 p.*
- and L. Canseco-Márquez. 2004. Nuevas especies y cambios taxonómicos para la herpetofauna de México. *Acta Zoologica Mexicana (n.s.)* 20:115–144.
- , E. Hernández García, and A. Nieto-Montes de Oca. 1991. Catálogo de anfibios y reptiles del Museo de Zoología, Facultad de Ciencias, Universidad Nacional Autónoma de México. *Serie Catálogos del Museo de Zoología "Alfonso L. Herrera" (3):8 unnumbered + 1–222 p.*
- and J.A. Hernández Gómez. 1988. Ranas, p. 6860–6861. *In* J.R.D. Álvarez (ed.), *Enciclopedia de México. Tomo XII, Vol. 12, Edición Especial* ed. Compañía Editora de Enciclopedias de México, S. A. de C. V., México.
- , G. Perez Higadera, R.C. Vogt, and M. Palma Muñoz. 1987. Claves para los Géneros y las Especies de Anfibios y Reptiles de la Región de Los Tuxtlas. Universidad Nacional Autónoma de México.
- Fouquette Jr., M.J. 1960a. Notes on a collection of anurans from the Canal Zone. *Herpetologica* 16: 58.
- . 1960b. Call structure in frogs of the Family Leptodactylidae. *The Texas Journal of Science* 12:201–215.
- Frank, N. and E. Ramus. 1995. *A Complete Guide to Scientific and Common Names of Reptiles and Amphibians of the World*. NG Publishing Inc., Pottsville, Pennsylvania.
- Frazer, J.F.D. 1967a. Amphibians (Class Amphibia), p. 268–282. *In* R.C. Murphy (ed.), *Larousse Encyclopedia of Animal Life*. Hamlyn, London.
- . 1967b. Amphibians (Class Amphibia), p. 268–282. *In* R.C. Murphy (ed.), *The Larousse Encyclopedia of Animal Life*. McGraw-Hill Book Company, New York, London, Toronto, Sydney, Johannesburg.
- Freiberg, M.A. 1972. Los Anfibios (Amphibia), p. 333–446. *In* L. Cendrero (ed.), *Zoología Hispanoamericana. Vertebrados*. Editorial Porrúa, Mexico City.
- Freytag, G.E. 1967. Klasse Amphibia - Lurche (Ordnung Salientia - Froschlurche), p. 292–355 + plates 81–102. *In* K. Deckert (ed.), *Urania Tierreich. Band 4. Fische, Lurche, Kriechtiere*. Urania-Verlag, Leipzig.
- Frost, D.R. (ed.). 1985. *Amphibian Species of the World: a Taxonomic and Geographical Reference*. Allen Press, Inc. & The Association of Systematics Collections, Lawrence, Kansas.
- Fugler, C.M. 1960. New herpetological records for British Honduras. *The Texas Journal of Science* 12:8–13.
- Gadow, H. 1901. *Amphibia and Reptiles*. Macmillan and Co., Limited, London.
- . 1905. The distribution of Mexican amphibians and reptiles. *Proceedings of the Zoological Society of London* 2:191–244.
- . 1910. The effect of altitude upon the distribution of Mexican amphibians and reptiles. *Zoologische Jahrbücher, Abteilung für Systematik, Geographie und Biologie der Tiere (Jena)* 29:689–714.
- . 1930. *Jorullo. The History of the Volcano of Jorullo and the Reclamation of the Devastated District by Animals and Plants*. Cambridge University Press, London.
- Gaige, H.T. 1936. Some reptiles and amphibians from Yucatan and Campeche, Mexico. *Carnegie Institution of Washington Publication (457):289–304*.
- Galindo-Leal, C. 2003. De Dos Mundos. Las Ranas, Sapos y Salamandras de la Península de Yucatán, México. *Of Two Worlds. The Frogs, Toads and Salamanders of the Yucatan Peninsula, Mexico*. Pangaea, Saint Paul, Minnesota.
- , J.R. Cedeño-Vásquez, R. Calderón, and J. Augustine. 2003. Arboreal frogs, tank bromeliads and disturbed seasonal tropical forest. *Contemporary Herpetology* 2003:1–10 + 6 figures + 1 table.
- Gallardo, J.M. 1964. *Leptodactylus prognathus* Boul. y *L. mystacinus* (Burm.) con sus respectivas especies aliadas ("Amphibia, Leptodactylidae" del grupo "Cavícola"). *Revista del Museo Argentino de Ciencias Naturales "Bernardino Rivadavia," Ciencias Zoológicas* 9:91–121 + 2 plates.
- Gans, C. and R. Pyles. 1983. Narial closure in toads; which muscles? *Respiration Physiology* 53:215–223.
- García, A. 2006. Using ecological niche modelling to identify diversity hotspots for the herpetofauna of Pacific lowlands and adjacent interior valleys of Mexico. *Biological Conservation* 130:25–46.
- Garrett, J.M. and D.G. Barker. 1987. *A Field Guide to Reptiles and Amphibians of Texas*. Texas Monthly Press, Inc., Austin.
- Gilboa, I. 1975 ("1974"). Karyotypes of amphibians & reptiles: a bibliographic review, p. 91–156. *In* H.G. Dowling (ed.), *Yearbook of Herpetology, Vol. 1. Herpetological Information Search Systems*, The American Museum of Natural History, New York.
- Glaw, F., J. Köhler, R. Hofrichter, and A. Dubois.

2000. Amphibian systematics: list of recent families, genera, and species, p. 252–258. In R. Hofrichter (ed.), *Amphibians: The World of Frogs, Toads, Salamanders and Newts*. Firefly Books, Buffalo.
- Goin, C.J. 1959. Notes on the maxillary dentition of some frogs of the genera *Eleutherodactylus* and *Leptodactylus*. *Herpetologica* 15:134–136.
- , O.B. Goin, and G.R. Zug. 1978. *Introduction to Herpetology*. Third Edition. W. H. Freeman and Company, San Francisco.
- González, M.J., O. Lara, and M. Jolón Morales. 1999. Lista oficial de la República de Guatemala, p. 35–58. In V. Solís, and O. Brenes (eds.), *Lista de Fauna de Importancia para la Conservación en Centroamérica y México: Listas Rojas, Listas Oficiales y Especies en Apéndices CITES*. UICN-ORMA, WWF, CCAD, SICA, San José, Costa Rica.
- Gorham, S.W. 1966. Liste der rezenten Amphibien und Reptilien: Ascaphidae, Leiopelmatidea [sic], Pipidae, Discoglossidae, Pelobatidae, Leptodactylidae, Rhinophrynidae. *Das Tierreich* (85):xvi + 222 p.
- . 1974. Checklist of World Amphibians up to January 1, 1970. Liste des Amphibiens du Monde d'après l'État du 1er Janvier 1970. The New Brunswick Museum, Saint John, New Brunswick, Canada.
- Gorzula, S.J. and J.C. Señaris. 1999 ("1998"). Contribution to the herpetofauna of the Venezuelan Guayana I. A data base. *Scientia Guaianae* 8:xviii + 268 p. + 129 color photographs + 4 annex maps.
- Greenbaum, E. and O. Komar. 2005. Threat assessment and conservation prioritization of the herpetofauna of El Salvador. *Biodiversity and Conservation* 14:2377–2395.
- Griffiths, I. 1963. The phylogeny of the Salientia. *Biological Reviews* 38:241–292 + 1 plate.
- Guibé, J. 1950. *Catalogue des types d'amphibiens du Muséum National d'Histoire Naturelle*. Muséum National d'Histoire Naturelle, Paris.
- Günther, A.C.L.G. 1900. Batrachia Salientia, p. 197–220. In D. Godman (ed.), *Biologia Centrali-Americana; or Contributions to the Knowledge of the Fauna and Flora of Mexico and Central America*. Zoology. Reptilia and Batrachia. Volume 165. R.H. Porter, London.
- . 1902. Geographical distribution of the reptiles and batrachians represented in Mexico and Central America, p. x–xvii. In D. Godman (ed.), *Biologia Centrali-Americana; or Contributions to the Knowledge of the Fauna and Flora of Mexico and Central America*. Zoology. Reptilia and Batrachia. Volume 165. R. H. Porter, London.
- Haas, A. 1996. Das larvale Cranium von *Gastrotheca riobambae* und seine Metamorphose (Amphibia, Anura, Hylidae). *Verhandlungen des Naturwissenschaftlichen Vereins in Hamburg (NF)* 36:33–162.
- Hailman, J.P. 1976. Oildroplets in the eyes of adult anuran amphibians: a comparative survey. *Journal of Morphology* 148:453–468.
- and R.G. Jaeger. 1974. Phototactic responses to spectrally dominant stimuli and use of colour vision by adult anuran amphibians: a comparative study. *Animal Behaviour* 22:757–795.
- Hamblin, N.L. 1984. *Animal use by the Cozumel Maya*. The University of Arizona Press, Tucson.
- Harding, K.A. 1983. *Catalogue of New World Amphibians*. Pergamon Press, Oxford, New York, Toronto, Sydney, Paris, Frankfurt.
- Hartweg, N. and J.A. Oliver. 1940. A contribution to the herpetology of the Isthmus of Tehuantepec. IV. University of Michigan Museum of Zoology, *Miscellaneous Publications* (47):1–31.
- Helling, H. 1938. Das Geruchsorgan der Anuren, vergleichend-morphologisch betrachtet. *Zeitschrift für Anatomie und Entwicklungsgeschichte* 108: 587–643.
- Henderson, R.W. and L.G. Hoeffers. 1975. A checklist and key to the amphibians and reptiles of Belize, Central America. Milwaukee Public Museum, *Contributions in Biology and Geology* (5):5 unnumbered + 63 p.
- Heyer, W.R. 1967. A herpetofaunal study of an ecological transect through the Cordillera de Tilarán, Costa Rica. *Copeia* 1967:259–271.
- . 1969a. The adaptive ecology of the species groups of the genus *Leptodactylus* (Amphibia, Leptodactylidae). *Evolution* 23:421–428.
- . 1969b. Studies on frogs of the genus *Leptodactylus* (Amphibia, Leptodactylidae). V. Taxonomic notes on *L. latinasus*, *rhodonotus*, *romani*, and *wuchereri*. *Herpetologica* 25:1–8.
- . 1970a. Studies on the frogs of the genus *Leptodactylus* (Amphibia: Leptodactylidae). VI. Biosystematics of the *melanonotus* group. Natural History Museum of Los Angeles County, *Contributions in Science* (191):1–48.
- . 1970b ("1968"). Studies on the genus *Leptodactylus* (Amphibia: Leptodactylidae). II. Diagnosis and distribution of the *Leptodactylus* of Costa Rica. *Revista de Biología Tropical* 16:171–205.
- . 1971. *Leptodactylus labialis*. *Catalogue of American Amphibians and Reptiles* (104):1–3.
- . 1974. Relationships of the *marmoratus* species group (Amphibia, Leptodactylidae) within the subfamily Leptodactylinae. Natural History Museum of Los Angeles County, *Contributions in Science* (253):1–46.
- . 1978. Systematics of the fuscus group of the frog genus *Leptodactylus* (Amphibia, Leptodactylidae). Natural History Museum of Los Angeles County, *Science Bulletin* (29):1 unnumbered + 85 p.
- . 1983. Clarification of the names *Rana mystacea* Spix, 1824, *Leptodactylus amazonicus* Heyer, 1978 and a description of a new species, *Leptodactylus spixi* (Amphibia: Leptodactylidae). *Proceedings of the Biological Society of Washington* 96:270–272.
- . 1988. On frog distribution patterns east of the Andes, p. 245–273. In P.E. Vanzolini and W.R. Heyer (eds.), *Proceedings of a Workshop on Neotropical Distribution Patterns Held 12-16 January*

1987. Academia Brasileira de Ciências, Rio de Janeiro.
- . 1995. South American rocky habitat *Leptodactylus* (Amphibia: Anura: Leptodactylidae) with description of two new species. *Proceedings of the Biological Society of Washington* 108:695–716.
- . 2002. *Leptodactylus fragilis*, the valid name for the Middle American and northern South American White-lipped Frog (Amphibia: Leptodactylidae). *Proceedings of the Biological Society of Washington* 115:321–322.
- . 2005. *Leptodactylus fragilis* Brocchi, 1877. White-lipped Frog, p. 500–501. In M. Lannoo (ed.), *Amphibian Declines: The Conservation Status of United States Species*. University of California Press, Berkeley, Los Angeles, London.
- , R.O. de Sá, and S. Muller. 2002. *Leptodactylus silvanimbus*. *Catalogue of American Amphibians and Reptiles* (743):1–3.
- , –, and –. 2005. On the enigmatic distribution of the Honduran endemic *Leptodactylus silvanimbus* (Amphibia: Anura: Leptodactylidae), p. 81–101. In M.A. Donnelly, B.I. Crother, C. Guyer, M.H. Wake, and M.E. White (eds.), *Ecology and Evolution in the Tropics. A Herpetological Perspective*. The University of Chicago Press, Chicago & London.
- and M.J. Diment. 1974. The karyotype of *Vanzolinius discodactylus* and comments on usefulness of karyotypes in determining relationships in the *Leptodactylus*-complex (Amphibia, Leptodactylidae). *Proceedings of the Biological Society of Washington* 87:327–336.
- and M.M. Heyer. 2001. *Leptodactylus lithonaetes*. *Catalogue of American Amphibians and Reptiles* (723):1–3.
- and –. 2002. *Leptodactylus elenae*. *Catalogue of American Amphibians and Reptiles* (742):1–5.
- and F.A. Juncá. 2003. *Leptodactylus caatingae*, a new species of frog from eastern Brazil (Amphibia: Anura: Leptodactylidae). *Proceedings of the Biological Society of Washington* 116:317–329.
- and L.R. Maxson. 1982. Distributions, relationships, and zoogeography of lowland frogs: the *Leptodactylus* complex in South America, with special reference to Amazonia, p. 375–388. In G.T. Prance (ed.), *Biological Diversification in the Tropics*. Columbia University Press, New York.
- and A.S. Thompson. 2000. *Leptodactylus rugosus*. *Catalogue of American Amphibians and Reptiles* (708):1–5.
- Himmelstein, J. 1981 ("1980"). Observations and distributions of amphibians and reptiles in the State of Quintana Roo, Mexico. *HERP Bulletin of the New York Herpetological Society* 16:18–34.
- Höbel, G. 2004a. Fortpflanzungsstrategien der Froschlurche Costa Ricas. Teil 1. Die Aquarien- und Terrarienzeitschrift 57(7):38–42.
- . 2004b. Fortpflanzungsstrategien der Froschlurche Costa Ricas. Schluss. Die Aquarien- und Terrarienzeitschrift 57(8):24–27.
- Hödl, W. 1996. Die Reptilien- und Amphibienfauna Costa Ricas, p. 56–76. In P. Sehnaal, and H. Zettler (eds.), *Esquinas-Nationalpark. Der Regenwald der Österreicher in Costa Rica*. Naturhistorisches Museum Wien, Wien.
- Holman, J.A. 1970 ("1969"). A small Pleistocene herpetofauna from Tamaulipas. *Quarterly Journal of the Florida Academy of Sciences* 32:153–158.
- . 2003. *Fossil Frogs and Toads of North America*. Indiana University Press, Bloomington and Indianapolis.
- Hoogmoed, M.S. and S.J. Gorzula. 1979. Checklist of the savanna inhabiting frogs of the El Manteco region with notes on their ecology and the description of a new species of treefrog (Hylidae, Anura). *Zoologische Mededelingen* 54:183–216 + 3 plates.
- Ibáñez D., R., F.A. Arosemena, F.A. Solís, and C.A. Jaramillo A. 1995 ("1994"). Anfíbios y reptiles de la Serranía Piedras-Pacora, Parque Nacional Chagres. *Scientia (Panamá)* 9:17–31.
- , C.A. Jaramillo A., M. Arrunátegui, Q.D. Fuenmayor, and F.A. Solís. 1997 ("1995"). Inventario biológico del Canal de Panamá. *Estudio herpetológico. Scientia (Panamá) Número Especial (2):111–159*.
- , A.S. Rand, and C.A. Jaramillo A. 1999a. Los Anfíbios del Monumento Natural Barro Colorado, Parque Nacional Soberanía y Áreas Adyacentes. *The Amphibians of Barro Colorado Nature Monument, Soberanía National Park and Adjacent Areas*. Editorial Mizrachi & Pujol, S. A., Panamá.
- , –, M.J. Ryan, and C.A. Jaramillo A. 1999b. Vocalizaciones de Ranas y Sapos del Monumento Natural Barro Colorado, Parque Nacional Soberanía y Áreas Adyacentes. *Vocalizations of Frogs and Toads from Barro Colorado Nature Monument, Soberanía National Park and Adjacent Areas*. Fundación Natura, Circulo Herpetológico de Panamá, Smithsonian Tropical Research Institute, Costa Rica.
- , F.A. Solís, C.A. Jaramillo A., and A.S. Rand. 2001. An overview of the herpetology of Panama, p. 159–170. In J.D. Johnson, R.G. Webb, and O.A. Flores-Villela (eds.), *Mesoamerican Herpetology: Systematics, Zoogeography, and Conservation*. Centennial Museum, The University of Texas at El Paso, Special Publication (1).
- Iremonger, S., R. Sayre, J.R. Meyer, B. Miller, C. Miller, T. Boomsma, J. Mackler, and R. Mackler. 1994. A Rapid Ecological Assessment of the Bladen Nature Reserve, Belize. *The Nature Conservancy, Belize Audubon Society, Ministry of Natural Resources, Belize, Arlington, Virginia*.
- Ives, J.E. 1892 ("1891"). Reptiles and batrachians from northern Yucatan and Mexico. *Proceedings of the Academy of Natural Sciences of Philadelphia* 1891:458–463.
- Jaeger, R.G. and J.P. Hailman. 1973. Effects of intensity on the phototactic responses of adult anuran amphibians: a comparative survey. *Zeitschrift für Tierpsychologie* 33:352–407.
- Jameson, D.L. 1955. Evolutionary trends in the courtship and mating behavior of Salientia. *Systematic Zoology* 4:105–119.
- Jiménez-Cruz, R., J. Schmitter, A. Muñoz-Alonso, R. Cedeño-Vásquez, J. Morales-Alvarez, C. Barriender

- tos, F. Casteñada-Moya, J.R. Meyer, and J.C. Lee. 1998. Amphibians and reptiles: recommendations and priorities for monitoring. Recomendaciones y prioridades para el monitoreo de anfibios y reptiles, p. 169–176. *In* O. Herrera-MacBryde (ed.), *Maya Forest Biodiversity Workshop: Inventorying and Monitoring. Taller sobre Inventario y Monitoreo de Biodiversidad de la Selva Maya*. Fores, Petén, Guatemala. 29 September–3 October 1997. SI/MAB: Measuring, Monitoring and Assessing Biodiversity Program, Smithsonian Institution, Washington, D. C.
- Johnson, J.D. 1989. A biogeographic analysis of the herpetofauna of northwestern nuclear Central America. Milwaukee Public Museum, Contributions in Biology and Geology (76):1–66.
- . 1990. Biogeographic aspects of the herpetofauna of the central depression of Chiapas, México, with comments on surrounding areas. *The Southwestern Naturalist* 35:268–278.
- Kellogg, R. 1932. Mexican tailless amphibians in the United States National Museum. United States National Museum Bulletin (160):iv + 224 p. + 1 plate.
- Killebrew, F.C. 1990. [Review of] Amphibians and Reptiles of Texas: With Keys, Taxonomic Synopses, Bibliography, and Distribution Maps. By James R. Dixon. Texas A & M University Press, College Station, Texas, 1987, 435 pp. illus. + maps. *Herpetologica* 46:128–129.
- Kime, N.M., W.R. Turner, and M.J. Ryan. 2000. The transmission of advertisement calls in Central American frogs. *Behavioral Ecology* 11:71–83.
- King, M. 1990. *Amphibia Gebrüder. Borntraeger*, Berlin, Stuttgart.
- Klingelhöffer, W. and C. Scherpner. 1956. *Lurche, Zweiter Teil, Zweite Auflage. Alfred Kernen Verlag, Stuttgart*.
- Kluge, A.G. and J.S. Farris. 1969. Quantitative phyletics and the evolution of anurans. *Systematic Zoology* 18:1–32.
- Köhler, G. 1999a. The amphibians and reptiles of Nicaragua. A distributional checklist with keys. *Courier Forschungsinstitut Senckenberg* (213):1–121.
- . 1999b. Herpetologische Beobachtungen in Honduras. II. Das Comayagua-Becken. *Natur und Museum* 129:212–217.
- . 2001. *Anfibios y Reptiles de Nicaragua*. Herpeton, Verlag Elke Köhler, Offenbach, Germany.
- , M. Vesely, and E. Greenbaum. 2005 (“2006”). *The Amphibians and Reptiles of El Salvador*. Krieger Publishing Company, Malabar, Florida.
- Krywicki, J. 2001. Sunlight in the rain forest. *Reptiles* 9:10–27.
- Kuramoto. 1990. A list of chromosome numbers of anuran amphibians. *Bulletin of Fukuoka University of Education* 39:83–127.
- La Marca, E. 1992. Catálogo taxonómico, biogeográfico y bibliográfico de las ranas de Venezuela. Cuadernos Geográficos, Universidad de Los Andes, Mérida (9):1–197.
- . 1995. Crisis de biodiversidad en anfibios de Venezuela: estudio de casos, p. 47–70. *In* M.E. Alonso (ed.), *Cuadernos de Química Ecológica*, Vol. 4.
- . 1997. Lista actualizada de los anfibios de Venezuela, p. 103–120. *In* E. La Marca (ed.), *Vertebrados Actuales y Fósiles de Venezuela*, Vol. 1. Museo de Ciencia y Tecnología de Mérida, Venezuela, Mérida, Venezuela.
- and J.E. Garcia P. 1987. Hábitos alimentarios de dos especies de culebras “reinitas” de Venezuela (Feeding habits of two “little queen” snakes from Venezuela), *Liophis melanotus* y *L. epinephelus* [Abstract]. AsoVac. Capítulo Zuliano, 37a. Convención Annual, 6tas. Jornadas Científico-Técnicas de Ingeniería, III Seminario Nacional de la Investigación en las Universidades Nacionales, Universidad del Zulia, Maracaibo, 22–27 de Noviembre 1987:268.
- Langone, J.A. and R.O. de Sá. 2005. Redescrición de la morfología larval externa de dos especies del grupo de *Leptodactylus fuscus* (Anura, Leptodactylidae). *Phyllomedusa* 4:49–59.
- Larson, P.M. and R.O. de Sá. 1998. Chondrocranial morphology of *Leptodactylus* larvae (Leptodactylidae: Leptodactylinae): its utility in phylogenetic reconstruction. *Journal of Morphology* 238:287–305.
- Lazcano, D., J. Banda, G. Castañeda, C. García-de la Peña, and C. Solís Rojas. 2006. Notes on Mexican herpetofauna 8: herpetofauna of the Parque Ecológico Chipinque, Nuevo León, Mexico. *Bulletin of the Chicago Herpetological Society* 41:117–123.
- Lazcano-Barrero, M.A., E. Gongora-Arones, and R.C. Vogt. 1992. Anfibios y reptiles de la Selva Lacandona, p. 145–171. *In* M.A. Vázquez-Sánchez, and M.A. Ramos Olmos (eds.), *Publicaciones Especiales Ecosfera*, Vol. 1.
- Lee, J.C. 1980. An ecogeographic analysis of the herpetofauna of the Yucatán Peninsula. University of Kansas Museum of Natural History, Miscellaneous Publication (67):1 unnumbered + 75 p.
- . 1993. Geographic variation in size and shape of Neotropical frogs: a precipitation gradient analysis. *Museum of Natural History, University of Kansas, Occasional Papers* (163):1–20.
- . 1996. *The Amphibians and Reptiles of the Yucatán Peninsula*. Comstock Publishing Associates, Cornell University Press, Ithaca and London.
- . 2000. *A Field Guide to the Amphibians and Reptiles of the Maya World: The Lowlands of Mexico, Northern Guatemala, and Belize*. Comstock Publishing Associates, Cornell University Press, Ithaca, London.
- Leenders, T.A.A.M. 2001. *A Guide to Amphibians and Reptiles of Costa Rica*. Distribuidores Zona Tropical, S. A., Miami.
- . 2003. Los anfibios y reptiles. Amphibians and reptiles, p. 144–161, 208–210. *In* J.M. Alvarez, and O. Komar (eds.), *El Parque Nacional El Imposible y su Vida Silvestre. El Imposible National Park and its Wildlife*. *Salva Natura*, San Salvador (El Salvador).
- and G.J. Watkins-Colwell. 2004. Notes on a collection of amphibians and reptiles from El Salvador.

- Postilla (231):1-31.
- León, P.E. 1970 ("1969"). Report of the chromosome numbers of some Costa Rican anurans. *Revista de Biología Tropical* 17:119-124.
- Lescure, J. 1972. Contribution à l'étude des amphibiens de Guyane Française II. *Leptodactylus fuscus* (Schneider). Observations écologiques et éthologiques. *Annales Muséum d'Histoire naturelle de Nice* 1:91-100.
- Levell, J.P. 1995. A Field Guide to Reptiles and the Law. *Serpent's Tale*, Excelsior, Minnesota.
- . 1997. A Field Guide to Reptiles and the Law. Revised Second Edition. *Serpent's Tale*, Lanesboro, Minnesota.
- Leviton, A.E. 1971. Reptiles and Amphibians of North America. Chanticleer Press Edition. Doubleday and Company, Inc., New York.
- Limeses, C.E. 1969. Las especies argentinas del género *Leptodactylus* (Anura, Leptodactylidae). Algunos aspectos anatómicos de posible significación taxonómica. Parte I. *Physis* 28:457-470.
- Liner, E.A. 1992a. Mexico bound III. *Gulf Coast Herpetological Society Newsletter* 2:12-21.
- . 1992b. Mexico bound IV. *Gulf Coast Herpetological Society Newsletter* 3:5-7.
- . 1992c. Bibliography and scientific name index to amphibians and reptiles in the publications of the Biological Society of Washington Bulletin 1-8, 1918-1988 and Proceedings 1-100, 1882-1987. *Smithsonian Herpetological Information Service* (92):1-68.
- . 1994. Scientific and common names for the amphibians and reptiles of Mexico in English and Spanish. Nombres científicos y comunes en Inglés y Español de los anfibios [sic] y los reptiles de México. *Society for the Study of Amphibians and Reptiles, Herpetological Circular* (23):v + 113 p.
- . 1995. Bibliography and scientific name index to amphibians and reptiles of the Transactions of the Kansas Academy of Sciences volumes 1-95, 1872-1992. *Smithsonian Herpetological Information Service* (104):1-59.
- . 1997. Bibliography and scientific name index to the amphibians and reptiles of the Florida Academy of Sciences, Volume 1-55, 1937-1992, The Florida Field Naturalist, Volume 1-20, 1973-1992, and The Florida Naturalist, Volume 1-65, 1926-1992. *Smithsonian Herpetological Information Service* (113):1-39.
- . 1998. Bibliography and scientific name index to amphibians [sic] and reptiles in the Proceedings and Transactions of the Texas Academy of Science, Volume 1-30 (1892-1948), Special Publications of the Texas Academy of Science, 2 Editions (1936-1938), and the Texas Journal of Science, Volumes 1-45 (1949-1993). *Smithsonian Herpetological Information Service* (119):1-44.
- . 1999. Bibliography and scientific name index to amphibians and reptiles in the Bulletin of the Florida State Museum of Natural History, Volumes 1-39, 1945-1996 & The Plaster Jacket, Numbers 1-46, 1966-1984. *Smithsonian Herpetological Information Service* (121):1-38.
- and H.A. Dundee. 1969. Notes on reptiles and amphibians from southern Guerrero and Oaxaca, Mexico. *The Southwestern Naturalist* 14:129-134.
- and H.D. Walley. 1997. Bibliography and scientific name index to amphibians and reptiles in the Southwestern Naturalist Volumes 1-40, 1956-1995. *Smithsonian Herpetological Information Service* (117):1-69.
- Lips, K.R., J.D. Reeve, and L. R. Witters. 2003. Ecological traits predicting amphibian population declines in Central America. *Conservation Biology* 17:1078-1088.
- and J.M. Savage. 1996. Key to the known tadpoles (Amphibia: Anura) of Costa Rica. *Studies on Neotropical Fauna and Environment* 31:17-26.
- Livezey, R.L. and A.H. Wright. 1947. A synoptic key to the salientian eggs of the United States. *The American Midland Naturalist* 37:179-222.
- Lockington, W.N. 1884. Review of the progress of North American batrachology in the years 1880-1883. *The American Naturalist* 18:149-154.
- Lynch, J.D. 1971. Evolutionary relationships, osteology, and zoogeography of leptodactyloid frogs. *University of Kansas Museum of Natural History, Miscellaneous Publication* (53):1-238.
- and C.M. Fugler. 1965. A survey of the frogs of Honduras. *Journal of the Ohio Herpetological Society* 5:5-18.
- and Á.M. Suárez-Mayorga. 2004. Anfíbios en el Chocó biogeográfico, p. 633-667. *In* J.O. Rangel-Ch. (ed.), *Colombia Diversidad Biológica IV. El Chocó Biogeográfico/Costa Pacífica*. Universidad Nacional de Colombia, Unibiblos, Bogotá.
- Maldonado-Koerdell, M. 1949. Notas anfibiológicas. III. Sobre algunos anuros del Estado de Nuevo León, México. *Revista de la Sociedad Mexicana de Historia Natural* 10:247-250.
- . 1953. Anfíbios, p. 107-120. *In* E. Beltrán (ed.), *Vida Silvestre y Recursos Naturales a lo Largo de la Carretera Panamericana*. Instituto Mexicano de Recursos Naturales Renovables, A.C., Mexico, D.F.
- Martin, P.S. 1958. A biogeography of reptiles and amphibians in the Gomez Farias region, Tamaulipas, Mexico. *University of Michigan Museum of Zoology, Miscellaneous Publications* (101):1-102 + 7 plates.
- Martin, R.F. 1972. Arciferal dextrality and sinistrality in anuran pectoral girdles. *Copeia* 1972:376-381.
- Martín del Campo, R. 1953. Contribución al conocimiento de la herpetología de Nuevo León. *Universidad (Nuevo León)* (11):115-152.
- Martínez Gracida, M. 1891. *Flora y Fauna del Estado Libre y Soberano de Oaxaca*. Imprenta del Estado, Oaxaca.
- Martínez Cortés, V. 1984. Investigación preliminar de los anfibios (Salientia) de Quebrada de Arena y áreas adyacentes: listado anotado. *Natura (Panamá)* 4:30-33.
- Maslin, T.P. 1963a. Notes on some anuran tadpoles from Yucatán, Mexico. *Herpetologica* 19:122-

- 128.
- . 1963b. Notes on a collection of herpetozoa from the Yucatán Peninsula of Mexico. University of Colorado Studies, Series in Biology (9):1-20.
- Mata-López, R. and V. León-Règagnon. 2005. *Gorgoderina festoni* n. sp. (Digenea: Gorgoderidae) in anurans (Amphibia) from Mexico. Systematic Parasitology 62:185-190.
- Maxson, L.R. and W.R. Heyer. 1988. Molecular systematics of the frog genus *Leptodactylus* (Amphibia: Leptodactylidae). Fieldiana, Zoology, New Series (41):iii + 13 p.
- McCoy Jr., C.J. and E.J. Censky. 1992. Biology of the Yucatan hognosed pitviper, *Porthidium yucatanicum*, p. 217-222. In J.A. Campbell and E.D. Brodie Jr. (eds.), Biology of the Pitvipers. Selva, Tyler, Texas.
- McCranie, J.R., F.E. Casteñeda, and K.E. Nicholson. 2002. Preliminary results of herpetofaunal survey work in the Rus Rus Region, Honduras: a proposed biological reserve. Herpetological Bulletin (81):22-29.
- , J.H. Townsend, and L.D. Wilson. 2006. The Amphibians and Reptiles of the Honduran Mosquitia. Krieger Publishing Company, Malabar, Florida.
- and L.D. Wilson. 2002. The amphibians of Honduras. Society for the Study of Amphibians and Reptiles, Contributions to Herpetology (19):x + 625 + 20 color plates.
- McDiarmid, R.W. 1987. Amphibians, p. 3-9. In R.C. Banks, R.W. McDiarmid, and A.L. Gardner (eds.), Checklist of Vertebrates of the United States, the U.S. Territories, and Canada. Resource Publication 166. United States Department of the Interior Fish and Wildlife Service, Washington, D.C.
- . 1995. Foreword to the 1995 printing, p. xi-xxii. Handbook of the Frogs and Toads of the United States and Canada. Third Edition. Comstock Classic Handbooks. Cornell Paperbacks, Ithaca, New York.
- and R. Altig. 1999. Research: materials and techniques, p. 7-23. In R.W. McDiarmid and R. Altig (eds.), Tadpoles: the Biology of Anuran Larvae. The University of Chicago Press, Chicago and London.
- and M.S. Foster. 1981. Breeding habits of the toad *Bufo coccifer* in Costa Rica, with a description of the tadpole. The Southwestern Naturalist 26:353-363.
- and J.M. Savage. 2005. The herpetofauna of the Rincón area, Peninsula de Osa, Costa Rica, a Central American lowland evergreen forest site, p. 366-427. In M.A. Donnelly, B.I. Crother, C. Guyer, M.H. Wake, and M.E. White (eds.), Ecology and Evolution in the Tropics. A Herpetological Perspective. The University of Chicago Press, Chicago and London.
- Meerman, J. 1993. Checklist of the reptiles and amphibians of the Shipstern Nature Reserve and Sarteneja, Corozal District, Belize. Occasional Papers of the Belize Natural History Society 2: 65-69.
- Mello Leitão, C.de. 1947. Zoogeografia do Brasil. Second Edition. Biblioteca Pedagógica Brasileira, Brasileira Série 5, Volume 77. Companhia Editora Nacional, São Paulo.
- Mendelson III, J.R. 1990. Notes on a collection of amphibians and reptiles from Finca Pueblo Viejo, Alta Verapaz, Guatemala. Fundación Interamericana de Investigación Tropical, Publicación Ocasional (3):1-18.
- Mertens, R. 1952a. Die Amphibien und Reptilien von El Salvador, auf Grund der Reisen von R. Mertens und A. Zilch. Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft (487): 1-120.
- . 1952b. Zur Kenntnis der Amphibien-Fauna von El Salvador. Senckenbergiana 33:169-171.
- Metcalf, M.M. 1923. The opalinid ciliate infusorians. United States National Museum Bulletin (120):vii + 484 p.
- Meyer, J.R. and C.F. Foster. 1996. A Guide to the Frogs and Toads of Belize. Krieger Publishing Company, Malabar, Florida.
- and J. Meerman. 2001. Amphibians of the Maya Mountains of Belize: biogeographical relationships and implications for ecosystem management, p. 65-79. In J.D. Johnson, R.G. Webb, and O.A. Flores-Villela (eds.), Mesoamerican Herpetology: Systematics, Zoogeography, and Conservation. Centennial Museum, The University of Texas at El Paso, Special Publication (1).
- and L.D. Wilson. 1971. A distributional checklist of the amphibians of Honduras. Natural History Museum of Los Angeles County, Contributions in Science (218):1-47.
- Mijares-Urrutia, A. and A. Arends R. 2000. Herpetofauna of Estado Falcón, northwestern Venezuela [sic]: a checklist with geographical and ecological data. Smithsonian Herpetological Information Service (123):1-30.
- Miyamoto, M.M. 1981. Congruence among character sets in phylogenetic studies of the frog genus *Leptodactylus*. Systematic Zoology 30:281-290.
- Mohr, E.V. 1963. The Study of Reptiles and Amphibians Made Simple. Doubleday and Company, Inc., Garden City, NY.
- Morescalchi, A. 1979. New developments in vertebrate cytotaxonomy I. Cytotaxonomy of the amphibians. Genetica 50:179-193.
- Mudde, P. and M. van Dijk. 1984. Herpetologische waarnemingen in Costa Rica (IV): Glaskikkers (Centrolenidae), Echte Kikkers (Ranidae) en Smalbekkikkers (Microhylidae). Lacerta 42:88-91.
- Mulaik, S. 1937. Notes on *Leptodactylus labialis* (Cope). Copeia 1937:72-73.
- Müller, F. 1884. Dritter Nachtrag zum Katalog der herpetologischen Sammlung des Basler Museums. Verhandlungen der Naturforschenden Gesellschaft in Basel 7:274-299 + 1 plate.
- Müller, P. 1973. The Dispersal Centres of Terrestrial Vertebrates in the Neotropical Realm. A Study in the Evolution of the Neotropical Biota and its Native Landscapes. Dr. W. Junk B.V., The Hague.
- Neill, W.T. 1965. New and noteworthy amphibians

- and reptiles from British Honduras. *Bulletin of the Florida State Museum, Biological Sciences* 9:77–130.
- and R. Allen. 1961. Further studies on the herpetology of British Honduras. *Herpetologica* 17:37–52.
- Nemuras, K.T. 1968. Notes on the Herpetology of Panama: Part 5. *Bulletin of the Maryland Herpetological Society* 4:8–19.
- Nieden, F. 1923. Amphibia. Anura I. Subordo Aglossa und Phaneroglossa, Sectio 1 Arcifera. *Das Tierreich* (46):xxxii + 584 p.
- Noble, G.K. 1918. The amphibians collected by the American Museum Expedition to Nicaragua in 1916. *Bulletin of the American Museum of Natural History* 38:311–347 + plates 14–19.
- Norman, D. 1998. Common Amphibians of Costa Rica. *Anfibios Comunes de Costa Rica*. Privately printed, Heredia, Costa Rica.
- Nussbaum, R.A. 1982. Heterotopic bones in the hindlimbs of frogs of the families Pipidae, Ranidae and Sooglossidae. *Herpetologica* 38:312–320.
- Obst, F.J., K. Richter, U. Jacob, W.-E. Engelmann, K. Eulenberger, H. Köhler, G. Peters, and H.-G. Petzold. 1984. *Lexikon der Terraristik und Herpetologie*. Landbuch-Verlag, Hannover.
- , –, –, and –. 1988. *The Completely Illustrated Atlas of Reptiles and Amphibians for the Terrarium*. T.F.H. Publications, Inc., Neptune, New Jersey.
- Oliver, J.A. 1955. *The Natural History of North American Amphibians and Reptiles*. D. Van Nostrand Company, Inc., Princeton, Toronto, London, New York.
- Orton, G.L. 1951. The tadpole of *Leptodactylus melanonotus* (Hallowell). *Copeia* 1951:62–66.
- . 1952. Key to the genera of tadpoles in the United States and Canada. *The American Midland Naturalist* 47:382–395.
- Öser, R. 1933. Meine Centralamerika-Reise. I. Blätter für Aquarien- und Terrarienkunde 44:75–78.
- . 1934. Weitere Zuchterfolge bei exotischen Fröschen. *Blätter für Aquarien- und Terrarienkunde* 45:366–367.
- Owen, J.G. and J.R. Dixon. 1989. An ecogeographic analysis of the herpetofauna of Texas. *The Southwestern Naturalist* 34:165–180.
- Páez, V.P., B.C. Bock, J.J. Estrada, A.M. Ortega, J.M. Daza, and P.D. Gutiérrez-C. 2002. Guía de Campo de Algunas Especies de Anfibios y Reptiles de Antioquia. Multimpresos Ltda., Medellín.
- Pearse, A.S. 1977. La fauna, p. 109–271. *In* F. Luna Kan (ed.), *Enciclopedia Yucatanense*. Segunda Edición. Tomo I. Introducción, Geografía Física, Fauna, Flora. Gobierno de Yucatán, Ciudad de México.
- Péfaur, J.E. 1992. Checklist and bibliography (1960–85) of the Venezuelan herpetofauna. *Smithsonian Herpetological Information Service* (89):1–54.
- and A. Díaz de Pascual. 1987. Distribución ecológica y variación temporal de los anfibios del Estado Barinas, Venezuela. *Revista de Ecología Latinoamericana* 1:9–20.
- and J.A. Rivero. 2000. Distribution, species-richness, endemism, and conservation of Venezuelan amphibians and reptiles. *Amphibian and Reptile Conservation* 2:42–70.
- Pelcastre Villafuerte, L. 1991. *Anfibios y Reptiles de Veracruz: Uso del Sistema de Información Climático - Cartográfica INIREB-IBM*. Tesis Profesional, Biólogo, Universidad Nacional Autónoma de México, México, D.F.
- and O.A. Flores-Villela. 1992. Lista de especies y localidades de recolecta de la herpetofauna de Veracruz, México. *Publicaciones Especiales del Museo de Zoología, Universidad Nacional Autónoma de México, Facultad de Ciencias, Departamento de Biología* (4):25–96.
- Pérez-Ramos, E., L. Saldaña de la Riva, and Z. Uribe-Peña. 2000. A checklist of the reptiles and amphibians of Guerrero, México. *Anales del Instituto de Biología Universidad Nacional Autónoma de México, Serie Zoología* 71:21–40.
- Pérez-Higareda, G., R.C. Vogt, and O.A. Flores-Villela. 1987. Lista Anotada de los Anfibios y Reptiles de la Región de Los Tuxtlas, Veracruz. *Instituto de Biología, Universidad Nacional Autónoma de México, México City*.
- Philibosian, R., R. Ruibal, V.H. Shoemaker, and L.L. McClanahan. 1974. Nesting behavior and early larval life of the frog *Leptodactylus bufonius*. *Herpetologica* 30:381–386.
- Pineda, E. and G. Halffter. 2004. Species diversity and habitat fragmentation: frogs in a tropical montane landscape in Mexico. *Biological Conservation* 117:499–508.
- , C. Moreno, F. Escobar, and G. Halffter. 2005. Frog, bat, and dung beetle diversity in the cloud forest and coffee agroecosystems of Veracruz, Mexico. *Conservation Biology* 19:400–410.
- Pocai, E. 1941. *Memória Histórica do Instituto de Butantan*. Privately published, São Paulo, Brazil.
- Ponssa, M.L. 2001. Miniaturización en especies del grupo *fuscus* del género *Leptodactylus* (Anura, Leptodactylidae), como consecuencia de procesos heterocronicos [Abstract]. IV Congreso Argentino de Herpetología, Salta, Argentina, 18 al 22 de Noviembre de 2001, Resúmenes:72–73.
- . 2004. Utilización especial y temporal de una comunidad de anuros de Kent's Marsh (Gamboa, Panamá). *Revista Española de Herpetología* 18:5–18.
- Powell, R., J.T. Collins, and E.D. Hooper Jr. 1998. *A Key to Amphibians and Reptiles of the Continental United States and Canada*. University Press of Kansas, Lawrence, Kansas.
- Pozo de la Tijera, C., E. Escobedo Cabrera, J.L. Rangel Salazar, and P. Viveros León. 1991. Fauna, p. 49–78. *In* T. Camarena-Luhrs, and S.I. Salazar-Vallejo (eds.), *Estudios Ecológicos Preliminares de la Zona Sur de Quintana Roo*. Centro de Investigaciones de Quintana Roo, Dirección de Investigación Científica, Chetumal, Quintana Roo.
- Pratt, H.S. 1935. *A Manual of Land and Fresh Water Vertebrate Animals of the United States (Exclusive of Birds)*. Second Edition. P. Blakiston's Son and Co., Inc., Philadelphia.

- Pyburn, W.F. 1963. Observations on the life history of the treefrog, *Phyllomedusa callidryas* (Cope). The Texas Journal of Science 15:155-170.
- . 1967. Breeding and larval development of the hylid frog *Phrynohyas spilomma* in southern Veracruz, México. Herpetologica 23:184-194.
- Rada de Martínez, D. 1976. Cariotipo de *Colostethus trinitatis* (Amphibia: Dendrobatidae). Acta Biológica Venezolana 9:213-220.
- Ramírez-Bautista, A. and A. Nieto-Montes de Oca. 1997. Ecogeografía de anfibios y reptiles, p. 523-532. In E.G. Soriano, R. Dirzo, and R.C. Vogt (eds.), Historia Natural de Los Tuxtlas. Universidad Nacional Autónoma de México, México.
- Ramírez Granados, R. and S.A. Guzmán del Prío. 1963. Nociones sobre la propagación artificial de la rana. Trabajos de Divulgación, Contribución del Instituto Nacional de Investigaciones Biológico-Pesqueras (México) 5:1-16 + 1 unnumbered.
- Ramirez, J., R.C. Vogt, and J.-L. Villarreal Benítez. 1998. Population biology of a Neotropical frog (*Rana vaillanti*). Journal of Herpetology 32:338-344.
- Rand, A.S. 1957. Notes on amphibians and reptiles from El Salvador. Fieldiana, Zoology 34:505-534.
- and C.W. Myers. 1990. The herpetofauna of Barro Colorado Island, Panama: an ecological summary, p. 386-409. In A.H. Gentry (ed.), Four Neotropical Rainforests. Yale University Press, New Haven, London.
- Raun, G.G. and F.R. Gehlbach. 1972. Amphibians and reptiles in Texas. The Dallas Museum of Natural History, Bulletin (2):ii + 61 p. + 140 maps.
- Reddell, J.R. 1977. A preliminary survey of the caves of the Yucatán Peninsula, p. 215-296. In J.R. Reddell (ed.), Association for Mexican Cave Studies Bulletin, Vol. 6.
- . 1981. A review of the cavernicole fauna of Mexico, Guatemala, and Belize. Texas Memorial Museum, The University of Texas at Austin, Bulletin (27):1-327.
- Reese, R.W. and I.L. Firschein. 1950. Herpetological results of the University of Illinois Field Expedition, Spring 1949. II. Amphibia. Transactions of the Kansas Academy of Science 53:44-54.
- Rendón R., A., T. Álvarez, and O.A. Flores-Villela. 1998. Herpetofauna de Santiago Jalahui, Oaxaca, México. Acta Zoologica Mexicana (n.s.) 75: 17-45.
- Renjifo, J.M. and M. Lundberg. 1999. Guía de Campo. Anfibios y Reptiles de Urrá. Editorial Colina, Medellín, Colombia.
- Rivero-Blanco, C. and J.R. Dixon. 1979. Origin and distribution of the herpetofauna of the dry lowland regions of northern South America, p. 281-298. In W.E. Duellman (ed.), Museum of Natural History, University of Kansas, Monograph, Vol. 7, Lawrence, Kansas.
- Roca Perea, R.L. 1982. Estrategias Reproductivas y Sucesión Temporal de una Comunidad de Anuros (Amphibia: Salientia) en Los Llanos Venezolanos (Estado Apure). Licenciado en Biología, Universidad Simón Bolívar, Sartenejas - Baruta, Venezuela.
- . 1985. Breeding patterns in an anuran community of the Venezuelan tropical savanna [Abstract]. Annual Meeting of the American Society of Ichthyologists and Herpetologists, 65th Annual Meeting, University of Tennessee, Knoxville:115.
- Rose, G.J., R. Zelick, and A.S. Rand. 1988. Auditory processing of temporal information in a neotropical frog is independent of signal intensity. Ethology 77:330-336.
- Rossman, D.A. 1963. The colubrid snake genus *Thamnophis*: a revision of the *sauritus* group. Bulletin of the Florida State Museum, Biological Sciences 7:99-178.
- Ruiz-Carranza, P.M., M.C. Ardila-Robayo, and J.D. Lynch. 1996. Lista actualizada de la fauna de Amphibia de Colombia. Revista de la Academia Colombiana de Ciencias Exactas, Físicas y Naturales 20:365-415.
- Ruthven, A.G. 1912. The amphibians and reptiles collected by the University of Michigan-Walker Expedition in southern Vera Cruz, Mexico. Zoologische Jahrbücher Abteilung für Systematik, Ökologie und Geographie der Tiere, Jena 32:295-332 + plates 6-11.
- Ryan, M.J. 1985. The Túngara Frog. A Study in Sexual Selection and Communication. The University of Chicago Press, Chicago and London.
- Salthe, S.N. and J.S. Mecham. 1974. Reproductive and courtship patterns, p. 309-521. In B. Lofts (ed.), Physiology of the Amphibia. Volume II. Academic Press, Inc., New York and London.
- Sánchez, A., M. Machado, and R.Á. Gavidia. 1999. Lista oficial de la República de El Salvador, p. 69-82. In V. Solís, and O. Brenes (eds.), Lista de Fauna de Importancia para la Conservación en Centroamérica y México: Listas Rojas, Listas Oficiales y Especies en Apéndices CITES. UICN-ORMA, WWF, CCAD, SICA, San José, Costa Rica.
- Sanchiz, B. 1998. Salientia. Verlag Dr. Friedrich Pfeil, München.
- Sasa, M. and A. Solórzano. 1995. The reptiles and amphibians of Santa Rosa National Park, Costa Rica, with comments about the herpetofauna of xerophytic areas. Herpetological Natural History 3:113-125.
- Sasa Marin, M. 2000. Phylogeography of Middle American dry forest herpetofauna: a test of biogeographical hypothesis. Ph.D. Dissertation, University of Texas at Arlington.
- Savage, J.M. 1973a. A Preliminary Handlist of the Herpetofauna of Costa Rica. First Edition. University of Southern California, Los Angeles.
- . 1973b. A Preliminary Handlist of the Herpetofauna of Costa Rica. First Edition, Slightly Revised. University of Southern California, Los Angeles.
- . 1980a. A synopsis of the larvae of Costa Rican frogs and toads. Bulletin of the Southern California Academy of Sciences 79:45-54.
- . 1980b. A Preliminary Handlist of the Herpetofauna of Costa Rica. Third Edition. Allan Hancock Foundation, University of Southern California, Los Angeles.

- geles.
- . 1980c. A Handlist with Preliminary Keys to the Herpetofauna of Costa Rica. Allan Hancock Foundation, University of Southern California, Los Angeles.
- . 2002. The Amphibians and Reptiles of Costa Rica. A Herpetofauna between Two Continents, between Two Seas. The University of Chicago Press, Chicago, London.
- and J. Villa. 1986. Introduction to the herpetofauna of Costa Rica. Introducción a la herpetofauna de Costa Rica. Society for the Study of Amphibians and Reptiles, Contributions to Herpetology (3):viii + 207 p.
- Sazima, I. 1975. Hábitos reproductivos e fase larvária de *Leptodactylus mystacinus* e *L. sibilatrix* (Anura, Leptodactylidae). Mestre em Zoologia, Universidade de São Paulo, São Paulo.
- Schmidt, K.P. 1928. Amphibians and land reptiles of Porto Rico, with a list of those reported from the Virgin Islands. New York Academy of Sciences, Scientific Survey of Porto Rico and the Virgin Islands 10(1):1-160 p.
- . 1941. The amphibians and reptiles of British Honduras. Field Museum of Natural History, Zoological Series 22:475-510.
- . 1953. A Check List of North American Amphibians and Reptiles. Sixth Edition. American Society of Ichthyologists and Herpetologists, University of Chicago Press, Chicago.
- and F.A. Shannon. 1947. Notes on amphibians and reptiles of Michoacan, Mexico. Fieldiana, Zoology 31:63-85.
- Schmitt, R. 1994. Herpetologische Impressionen von Nicaragua, p. 128-133. In H.-J. Herrmann and H. Zimmermann (eds.), Beiträge zur Biologie der Anuren. Tetra Verlag, Melle.
- Schmitter-Soto, J.J., F.A. Comín, E. Escobar-Briones, J. Herrera-Silveira, J. Alcocer, E. Suárez-Morales, M. Elías-Gutiérrez, V. Díaz-Arce, L.E. Marín, and B. Steinich. 2002. Hydrogeochemical and biological characteristics of cenotes in the Yucatan Peninsula (SE Mexico), p. 215-228. In J. Alcocer and S.S.S. Sarma (eds.), Advances in Mexican limnology: basic and applied aspects. Hydrobiologia (467).
- Scott, N.J., Jr. and S. Limerick. 1983. Reptiles and amphibians, p. 351-367. In D.H. Janzen (ed.), Costa Rican Natural History. University of Chicago Press, Chicago and London.
- , J.M. Savage, and D.C. Robinson. 1983. Checklist of reptiles and amphibians, p. 367-374. In D.H. Janzen (ed.), Costa Rican Natural History. University of Chicago Press, Chicago and London.
- Seib, R.L. 1984. Prey use in three syntopic neotropical racers. Journal of Herpetology 18:412-420.
- Señaris, J.C. and R.D. MacCulloch. 2005. Amphibians, p. 9-23. In T. Hollowell and R.P. Reynolds (eds.), Checklist of the Terrestrial Vertebrates of the Guiana Shield. Bulletin of the Biological Society of Washington (13):ix + 1 Unnumbered + 1-98 p.
- Senfft, W. 1935. *Leptodactylus labialis* Cope und seine Zucht. Wochenschrift für Aquarien- und Terrarienkunde 32:37-39.
- Shreve, B. 1957. Reptiles and amphibians from the Selva Lacandona. Bulletin of the Museum of Comparative Zoology at Harvard College 116: 242-248.
- Smith, H.M. 1938. Notes on reptiles and amphibians from Yucatán and Campeche, Mexico. Occasional Papers of the Museum of Zoology, University of Michigan (388):1-22 + 1 plate.
- . 1947. Notes on Mexican amphibians and reptiles. Journal of the Washington Academy of Sciences 37:408-412.
- . 1978. Amphibians of North America: a Guide to Field Identification. Golden Press, New York.
- . 1987. Current nomenclature for the names and material cited in Günther's Reptilia and Batrachia volume of the Biologia Centrali-Americana. Pages XXIII-LI + LXIX + xx + 326 pages + 76 plates. In K. Adler (ed.), Facsimile Reprints in Herpetology. Albert C. L. G. Günther, Biologia Centrali-Americana, Reptilia and Batrachia. 1987. Society for the Study of Amphibians and Reptiles.
- and H.K. Buechner. 1947. The influence of the Balcones Escarpment on the distribution of amphibians and reptiles in Texas. Bulletin of the Chicago Academy of Sciences (8):1-16.
- and R.B. Smith. 1969. Early Foundations of Mexican Herpetology. An Annotated and Indexed Bibliography of the Herpetological Publications of Alfredo Dugès, 1826-1910. University of Illinois Press, Urbana, Chicago, London.
- and –. 1973. Synopsis of the Herpetofauna of Mexico. Volume II. Analysis of the Literature Exclusive of the Mexican Axolotl. Eric Lundberg, Augusta, West Virginia.
- and –. 1976a. Synopsis of the Herpetofauna of Mexico. Volume III. Source Analysis and Index for Mexican Reptiles. John Johnson, North Bennington, Vermont.
- and –. 1976b. Synopsis of the Herpetofauna of Mexico. Volume IV. Source Analysis and Index for Mexican Amphibians. John Johnson, North Bennington, Vermont.
- and –. 1977. Synopsis of the Herpetofauna of Mexico. Volume V. Guide to Mexican Amphibiaenians and Crocodilians. Bibliographic Addendum II. John Johnson, North Bennington, Vermont.
- and –. 1979. Synopsis of the Herpetofauna of Mexico. Volume VI. Guide to Mexican Turtles. Bibliographic Addendum III. John Johnson, North Bennington, Vermont.
- and –. 1993. Synopsis of the Herpetofauna of Mexico. Vol. VII. Bibliographic Addendum IV and Index, Bibliographic Addenda II-IV, 1979-1991. University Press of Colorado, Niwot, Colorado.
- and E.H. Taylor. 1948. An annotated checklist and key to the Amphibia of Mexico. United States National Museum Bulletin (194):iv + 118 p.
- and –. 1966. Herpetology of Mexico. Annotated Checklists and Keys to the Amphibians and Reptiles. A Reprint of Bulletins 187, 194 and 199 of

- the U.S. National Museum, With a List of Subsequent Taxonomic Innovations. Eric Lundberg, Ashton, Maryland.
- Smith, P.W. and D.M. Darling. 1952. Results of a herpetological collection from eastern central Mexico. *Herpetologica* 8:81–86.
- and H.M. Smith. 1952 ("1951"). Notas sobre algunos anfibios y reptiles colectados en el Estado de Chiapas. *Anales del Instituto de Biología, México* 22:557–564.
- Smyth, H.R. 1962. *Amphibians and Their Ways*. The Macmillan Company, New York.
- Solano, H. 1987. Algunos aspectos de la biología reproductiva del sapito silbador *Leptodactylus fuscus* (Schneider)(Amphibia: Leptodactylidae). *Amphibia-Reptilia* 8:111–128.
- Solórzano, A. 2004. Serpientes de Costa Rica: Distribución, Taxonomía e Historia Natural. Snakes of Costa Rica: Distribution, Taxonomy, and Natural History. Instituto Nacional de Biodiversidad (INBio), Santo Domingo de Heredia, Costa Rica.
- Stafford, P.J. 1998. Amphibians and reptiles of the Cordillera de Guanacaste, Costa Rica; a field list with notes on colour patterns and other observations. *British Herpetological Society Bulletin* (62): 9–19.
- Starrett, P.H. 1968. The phylogenetic significance of the jaw musculature in anuran amphibians. Doctor of Philosophy, University of Michigan, Ann Arbor, Michigan.
- Staton, M.A. and J.R. Dixon. 1977. The herpetofauna of the Central Llanos of Venezuela: noteworthy records, a tentative checklist and ecological notes. *Journal of Herpetology* 11:17–24.
- Stejneger, L. 1904 ("1902"). The herpetology of Porto Rico. Report of the United States National Museum 1902:549–724 + plate 1.
- Stejneger, L. and T. Barbour. 1933. A Check List of North American Amphibians and Reptiles. Third Edition. Harvard University Press, Cambridge.
- and –. 1939. A Check List of North American Amphibians and Reptiles. Fourth Edition. Harvard University Press, Cambridge.
- and –. 1943. A checklist of North American amphibians and reptiles. Fifth Edition. *Bulletin of the Museum of Comparative Zoology at Harvard College* 93:xix + 260 p.
- Straughan, I.R. and W.R. Heyer. 1976. A functional analysis of the mating calls of the neotropical frog genera of the *Leptodactylus* complex (Amphibia, Leptodactylidae). *Papeís Avulsos de Zoología* 29: 221–245.
- Stuart, L.C. 1934. A contribution to a knowledge of the herpetological fauna of El Petén, Guatemala. *Occasional Papers of the Museum of Zoology, University of Michigan* (292):1–18.
- . 1935. A contribution to a knowledge of the herpetology of a portion of the savanna region of central Petén, Guatemala. *University of Michigan Museum of Zoology, Miscellaneous Publications* (29):1–56 + 4 plates + 1 map.
- . 1937. Some further notes on the amphibians and reptiles of the Peten forest of northern Guatemala. *Copeia* 1937:67–70.
- . 1948. The amphibians and reptiles of Alta Verapaz Guatemala. *University of Michigan Museum of Zoology, Miscellaneous Publications* (69):1–109 + 1 map.
- . 1950. A geographic study of the herpetofauna of Alta Verapaz, Guatemala. *Contributions from the Laboratory of Vertebrate Biology, University of Michigan* (45):1–77 + 9 plates + 1 map.
- . 1954. Herpetofauna of the southeastern highlands of Guatemala. *Contributions from the Laboratory of Vertebrate Biology, University of Michigan* (68): 1–65 + 4 plates.
- . 1958. A study of the herpetofauna of the Uaxactún-Tikal area of northern El Petén, Guatemala. *Contributions from the Laboratory of Vertebrate Biology, University of Michigan* (75):1–30.
- . 1963. A checklist of the herpetofauna of Guatemala. *University of Michigan Museum of Zoology, Miscellaneous Publications* (122):1–150.
- Sumichrast, F. 1880. Contribution à l'histoire naturelle du Mexique. I. Notes sur une collection de reptiles et de batraciens de la partie occidentale de l'Isthme de Tehuantepec. *Bulletin de la Société Zoologique de France* 5:162–190.
- . 1881. Note additionnelle à la première contribution à l'histoire naturelle du Mexique. *Bulletin de la Société Zoologique de France* 6:231–232.
- . 1882a. Contribución a la historia natural de México. I. Notas acerca de una colección de reptiles y batracios de la parte occidental del Istmo de Tehuantepec. *La Naturaleza, Periódico Científico de la Sociedad Mexicana de Historia Natural* 5:268–293.
- . 1882b. Enumeración de los batracios observados en la parte oriental y meridional de la República Mexicana. *La Naturaleza, Periódico Científico de la Sociedad Mexicana de Historia Natural* 6:78–84.
- Summers, K. 2002. Relative abundance of leaf litter anurans in primary forest in the Nusagandi Biological Reserve, Republic of Panama. *Herpetological Natural History* 9:69–73.
- Swanson, P.L. 1945. Herpetological notes from Panama. *Copeia* 1945:210–216.
- Taylor, E.H. 1932. *Leptodactylus albilabris* (Günther): a species of toad new to the fauna of the United States. *The University of Kansas Science Bulletin* 20:243–245.
- . 1944. Present location of certain herpetological and other type specimens. *The University of Kansas Science Bulletin* 30 (Part I):117–187.
- . 1947. A bibliography of Mexican amphibiology. *The University of Kansas Science Bulletin* 31 (Part II): 543–589.
- . 1949. A preliminary account of the herpetology of the State of San Luis Potosí, México. *University of Kansas Science Bulletin* 33 (Part I):169–215.
- . 1952. The frogs and toads of Costa Rica. *University of Kansas Science Bulletin* 35 (Part I):577–942.
- . 1953. Fourth contribution to the herpetology of San Luis Potosí. *University of Kansas Science Bulletin*

- 35 (Part II):1587–1614.
- . 1954. Additions to the known herpetological fauna of Costa Rica with comments on other species. No. 1. University of Kansas Science Bulletin 36 (Part I):597–639.
- and H.M. Smith. 1945. Summary of the collections of amphibians made in México under the Walter Rathbone Bacon traveling scholarship. Proceedings of the United States National Museum 95: 521–613 + plates 18–32.
- Tejera Nuñez, V.H. and O.A. Dupuy Loo. 1994. Notas sobre anfibios de Panamá con referencia especial a la colección del Museo de Vertebrados de la Universidad de Panamá. *Scientia (Panamá)* 9:33–57.
- and –. 2003. Anfibios del Museo de Vertebrados de la Universidad de Panamá, Catálogo. Museo de Vertebrados de la Universidad de Panamá, Panamá.
- Thomas, R.A. 1974. A checklist of Texas amphibians and reptiles. Texas Parks and Wildlife Department, Technical Series (17):a-b + 1–15.
- . 1976. A checklist of Texas amphibians and reptiles. [Revised Edition]. Texas Parks and Wildlife Department, Technical Series (17):a-b + 1–16.
- Torres-Orozco, R.E., C.L. Jimenez-Sierra, R.C. Vogt, and J.-L. Villarreal Benitez. 2002. Neotropical tadpoles: spatial and temporal distribution and habitat use in a seasonal lake in Veracruz, México. *Phyllomedusa* 1:81–91.
- Travis, N.T., J.R. Dixon, and C.R. Smith. 1999. Amphibians and Reptiles of Texas. Taxonomic and Distributional Inventory with Bibliography. Texas System of Natural Laboratories Index Series (No. HTX-99):xviii + 519 p.
- Turvey, S.T. and A.G. Cooper. 1999. Amphibians and reptiles of Monkey Bay National Park, Belize. *British Herpetological Society Bulletin* 69:20–30.
- Urbina-Cardona, J.N. and V.H. Reynoso. 2005. Recambio de anfibios y reptiles en el gradiente potrero-borde-interior en Los Tuxtlas, Veracruz, México. *m3m: Monografías Tercer Milenio* (4):191–207.
- Vences, M. and R. Schmitt. 1992. Herpetologische Beobachtungen in Nicaragua. *Die Amphibien (Fortsetzung)*. *Herpetofauna* 14:7–10.
- Villa, J. 1969a. Notes on *Conophis nevermanni*, an addition to the Nicaraguan herpetofauna. *Journal of Herpetology* 3:169–171.
- . 1969b ("1967"). Comportamiento defensivo de la "Rana Ternero," *Leptodactylus pentadactylus*. *Revista de Biología Tropical* 15:323–329.
- . 1970 ("1969"). Notas sobre la historia natural de la serpiente de los pantanos, *Tretanorhinus nigroluteus*. *Revista de Biología Tropical* 17:97–104.
- . 1971. Lista Tentativa de Vertebrados Inferiores de Nicaragua. Universidad Nacional Autónoma de Nicaragua, Managua.
- . 1972. Anfibios de Nicaragua. Introducción a su Sistemática, Vida y Costumbres. Instituto Geográfico Nacional y Banco Central de Nicaragua, Managua.
- . 1983. Peces, Anfibios y Reptiles Nicaraguenses: Lista y Bibliografía. Nicaraguan Fishes, Amphibians and Reptiles: a Checklist and Bibliography. Escuela de Ecología y Recursos Naturales, Universidad Centroamericana, Managua.
- , L.D. Wilson, and J.D. Johnson. 1988. Middle American Herpetology: a Bibliographic Checklist. University of Missouri Press, Columbia, Missouri.
- Vogt, R.C. 1997. Las ranas de Laguna del Zacatal, p. 500–503. *In* E.G. Soriano, R. Dirzo, and R.C. Vogt (eds.), *Historia Natural de Los Tuxtlas*. Universidad Nacional Autónoma de México, México.
- , J.-L. Villarreal Benítez, and G. Pérez-Higareda. 1997. Lista anotada de anfibios y reptiles, p. 507–522. *In* E.G. Soriano, R. Dirzo, and R.C. Vogt (eds.), *Historia Natural de Los Tuxtlas*. Universidad Nacional Autónoma de México, México.
- Wainwright, M. 2000. Costa Rica Field Guide. Amphibians. Double-sided plastic laminated sheet. Rainforest Publications, Costa Rica.
- Walley, H.D. 2000. Bibliography and scientific name index to amphibians and reptiles in the Occasional Papers of the Museum of Natural History, University of Kansas, Numbers 1–180, 1971–1995. *Smithsonian Herpetological Information Service* (128):1–45.
- Weimer, R., W. Feichtinger, F. Bolanos, and M. Schmid. 1993. Die Amphibien von Costa Rica Herpetologische. Eindrücke einer Forschungsreise. Teil III: Leptodactylidae (1). *Sauria* 15:19–24.
- Wells, K.D. 2001. The energetics of calling in frogs, p. 45–60. *In* M.J. Ryan (ed.), *Anuran Communication*. Smithsonian Institution Press, Washington and London.
- Werler, J.E. and H.M. Smith. 1952. Notes on a collection of reptiles and amphibians from Mexico, 1951–1952. *The Texas Journal of Science* 4:551–573.
- Wettstein, O. 1934. Ergebnisse der österreichischen biologischen Costa Rica-Expedition 1930. Die Amphibien und Reptilien. Sitzungsberichten der Akademie der Wissenschaften in Wien, Mathem.-naturw. Klasse Abteilung I, 143:1–39.
- Wever, E.G. 1985. *The Amphibian Ear*. Princeton University Press, Princeton, New Jersey.
- Wilczynski, W., A.S. Rand, and M.J. Ryan. 2002 ("2001"). Evolution of calls and auditory tuning in the *Physalaemus pustulosus* species group. *Brain, Behavior and Evolution* 58:137–151.
- Wilson, L.D. 1983. Update on the list of amphibians and reptiles known from Honduras. *Herpetological Review* 14:125–126.
- and D.E. Hahn. 1973. The herpetofauna of the Islas de la Bahía, Honduras. *Bulletin of the Florida State Museum, Biological Sciences* 17:93–150.
- and J.R. McCranie. 1993. Preliminary key to the known tadpoles of anurans from Honduras. *Royal Ontario Museum, Life Sciences Occasional Paper* (40):1–12.
- and –. 1994. Second update on the list of amphibians and reptiles known from Honduras. *Herpetological Review* 25:146–150.
- and –. 1998. The biogeography of the herpetofau-

- na of the subhumid forests of Middle America (Isthmus of Tehuantepec to northwestern Costa Rica). Royal Ontario Museum, Life Sciences Contributions (163):1 unnumbered + 1–50.
- and –. 2003. The conservation status of the herpetofauna of Honduras. *Amphibian and Reptile Conservation* 3:6–33.
- , –, and M.R. Espinal. 2001. The ecogeography of the Honduran herpetofauna and the design of biotic reserves, p. 109–158. *In* J.D. Johnson, R.G. Webb, and O.A. Flores-Villela (eds.), *Mesoamerican Herpetology: Systematics, Zoogeography, and Conservation*. Centennial Museum, The University of Texas at El Paso, Special Publication (1).
- , –, and L. Porras. 1979. New departmental records for reptiles and amphibians from Honduras. *Herpetological Review* 10:25.
- , –, and K.L. Williams. 1991. Additional departmental records for the herpetofauna of Honduras. *Herpetological Review* 22:69–71.
- , L. Porras, and J.R. McCranie. 1986. Distributional and taxonomic comments on some members of the Honduran herpetofauna [sic]. Milwaukee Public Museum, Contributions in Biology and Geology (66):1–18.
- Wright, A.A. and A.H. Wright. 1933. *Handbook of Frogs and Toads. The Frogs and Toads of the United States and Canada*. [First Edition]. The Comstock Publishing Co., Inc., Ithaca, New York.
- and –. 1942. *Handbook of Frogs and Toads. The Frogs and Toads of the United States and Canada*. Second Edition. Comstock Publishing Company, Inc., Ithaca, New York.
- Wright, A.H. 1935. Some rare amphibians and reptiles of the United States. *Proceedings of the National Academy of Sciences, USA* 21:340–345.
- and A.A. Wright. 1938. Amphibians of Texas. *Transactions of the Texas Academy of Science* 21:5–35 + 3 plates + 2 unnumbered pages (index).
- and –. 1949. *Handbook of Frogs and Toads of the United States and Canada*. Third Edition. Comstock Publishing Company, Inc., Ithaca, New York.
- Young, B.E., G. Sedaghatkish, E. Roca, and Q.D. Fuenmayor. 1999. El Estatus de la Conservación de la Herpetofauna de Panamá. Resumen del Primer Taller Internacional sobre la Herpetofauna de Panamá. The Nature Conservancy and Asociación Nacional para la Conservación de la Naturaleza (ANCON), Arlington, Virginia.
- , S.N. Stuart, J.S. Chanson, N.A. Cox, and T.M. Boucher. 2004. *Disappearing Jewels. The Status of New World Amphibians*. NatureServe, Arlington, Virginia.
- Zim, H.S. and H.M. Smith. 1956. *Reptiles and Amphibians. A Guide to Familiar American Species*. Revised Edition. Golden Press, New York.
- Zweifel, R.G. 1964. The life history of *Phrynohyas venulosa* (Salientia: Hylidae) in Panamá. *Copeia* 1964:201–208.

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Primary editor for this account, Twan Leenders.

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