



**FLORIDA
MUSEUM**
OF NATURAL HISTORY®

BULLETIN

ISLAND LISTS OF WEST INDIAN AMPHIBIANS AND REPTILES

Robert Powell and Robert W. Henderson, Editors

Vol. 51, No. 2, pp. 85–166

2012

UNIVERSITY OF FLORIDA

GAINESVILLE

The **FLORIDA MUSEUM OF NATURAL HISTORY** is Florida's state museum of natural history, dedicated to understanding, preserving, and interpreting biological diversity and cultural heritage.

The **BULLETIN OF THE FLORIDA MUSEUM OF NATURAL HISTORY** is a peer-reviewed journal that publishes results of original research in zoology, botany, paleontology, archaeology, and museum science. The Bulletin is published at irregular intervals, and volumes are not necessarily completed in any one year. Volumes contain between 150 and 300 pages, sometimes more. The number of papers contained in each volume varies, depending upon the number of pages in each paper, but four numbers is the current standard. Multi-author issues of related papers have been published together, and inquiries about putting together such issues are welcomed. Address all inquiries to the Managing Editor of the Bulletin.

Richard C. Hulbert Jr., *Editor*

Bulletin Committee

Ann S. Cordell

Richard C. Hulbert Jr.

Jacqueline Miller

Larry M. Page

Roger W. Portell, *Treasurer*

Irvy R. Quitmyer

David W. Steadman, *Ex officio Member*

ISSN: 0071-6154

Copyright © 2012 by the Florida Museum of Natural History, University of Florida. All rights reserved. Text, images and other media are for nonprofit, educational, and personal use of students, scholars, and the public. Any commercial use or republication by printed or electronic media is strictly prohibited without written permission of the museum.

Publication Date: May 25, 2012 Price: \$9.00

**Send communications concerning purchase or exchange
of this publication and manuscript queries to:**

Managing Editor of the Bulletin
Florida Museum of Natural History
University of Florida
P.O. Box 117800
Gainesville, FL 32611-7800 USA

FAX: 352-846-0287
Email: bulletin@flmnh.ufl.edu

ISLAND LISTS OF WEST INDIAN AMPHIBIANS AND REPTILES

Robert Powell¹ and Robert W. Henderson², Editors

TABLE OF CONTENTS

Introduction by Robert Powell and Robert W. Henderson	86
Literature Cited.....	i
Swan Islands by Robert Powell and Robert W. Henderson.....	91
Literature Cited.....	i
Bahama Islands and Turks & Caicos Islands by Sandra D. Buckner, Richard Franz, and R. Graham Reynolds.....	93
Literature Cited.....	i
Cayman Islands by Arthur C. Echternacht.....	111
Literature Cited.....	i
The Cuban Archipelago by Alberto R. Estrada.....	113
Literature Cited.....	i
Jamaica by Byron S. Wilson, Thera Edwards, and Robert Powell.....	126
Literature Cited.....	i
Hispaniola and Navassa by Robert Powell.....	129
Literature Cited.....	i
Puerto Rico and the Virgin Islands by Gregory C. Mayer.....	136
Literature Cited.....	i
Lesser Antilles by Robert W. Henderson and Michel Breuil.....	148
Literature Cited.....	i

¹Department of Biology, Avila University, Kansas City, Missouri 64145-1698, USA <robert.powell@avila.edu>

²Section of Vertebrate Zoology, Milwaukee Public Museum, Milwaukee, Wisconsin 53233, USA <henderson@mpm.edu>

INTRODUCTION

Robert Powell¹ and Robert W. Henderson²

We believe that monitoring and documenting changes in the composition and distribution of the West Indian herpetofauna is necessary and important. This vast complex of islands with disparate geological origins and biogeographic relationships with one another and the mainland Americas supports exceptionally abundant, diverse, and largely endemic populations of terrestrial amphibians and reptiles, and is ideally suited for studies that provide new insights into evolutionary and ecological relationships. In addition, we are motivated by increasingly critical conservation concerns in the region, which was identified as a biodiversity hotspot by Myers et al. (2000). A large majority of the islands are changing rapidly, resulting in dramatic alterations of habitats, nearly all of them mediated by human activities.

Thomas Barbour (1914, 1930, 1935, 1937) effectively initiated the documentation of the region's herpetofaunas by providing a series of increasingly comprehensive checklists. Although replete with inconsistencies reflecting the limited and localized research of those days, now outdated taxonomy, and data often based on anecdotal accounts, very short visits, and hastily formed impressions (Henderson & Powell 2005), they collectively constitute a baseline for comparisons with more modern efforts.

Thirty-seven years ago, Albert Schwartz and Richard Thomas (1975) provided the first scholarly effort to document amphibian and reptilian diversity in the West Indies when they published what has been hailed (Pregill & Crother 1999) as "the most valuable contribution to the biogeography of West Indian amphibians and reptiles in the past 50 years." This detailed, carefully researched checklist of the herpetofauna listed each species and the island(s) on which it occurred. Two years later, MacLean et al.

(1977), based largely on the Schwartz and Thomas checklist, published a paper wherein they listed the species of frogs, turtles, lizards, snakes, and crocodylians for each of the 627 islands then known to harbor amphibians and reptiles. Subsequently, Schwartz and Henderson (1988, 1991) provided an updated checklist and an overview of West Indian herpetology, and Powell et al. (1996) published an abbreviated list, each documenting substantive changes in our understanding of the diversity and distribution of the region's herpetofauna. Most recently, Powell and Henderson (1999, 2003) published two addenda to Powell et al. (1996) and S. Blair Hedges (2012) provided a regularly updated list of species with distribution maps (<http://caribherp.org>) — but no updated island-by-island list of West Indian amphibians and reptiles has appeared since the publication of MacLean et al. 35 years ago.

Although many of the documented changes reflect a better and more modern understanding of relationships among the islands' species and the resultant adjustments in taxonomy, many questions remain. For example, at least some widely distributed species almost certainly represent species complexes, with populations in different habitats on large islands or on different islands or island groups worthy of recognition as full species. For example, currently recognized Hispaniolan and Bahamian subspecies of *Anolis distichus* might well be distinct at the species level (e.g., Ng & Glor, 2011; Glor & Laport, in press), and Lesser Antillean populations of *Thecadactylus* probably represent several species-level taxa (Köhler & Vesely, 2011).

However, most documented changes illustrate the impact of human activities (e.g., Henderson & Powell 2001, 2009). The herpetofaunas of the

¹Department of Biology, Avila University, Kansas City, Missouri 64145-1698, USA <robert.powell@avila.edu>

²Section of Vertebrate Zoology, Milwaukee Public Museum, Milwaukee, Wisconsin 53233, USA <henderson@mpm.edu>

West Indies are in flux; human population growth takes its toll on the environment as land that once sustained forests is cleared for homes, agriculture, and charcoal production. Humans bring with them cats and dogs that prey on reptiles, and goats, burros, and cattle that crop vegetation to bare soil, eliminating critical ground cover and food for a variety of amphibians and reptiles. The mongoose was introduced to many islands in the 19th century, putatively to control rodent populations that were having a deleterious effect on sugar production. The impact on ground-dwelling lizards, snakes, and birds has frequently been catastrophic.

With many island economies increasingly based on tourism, development is rampant; with development come radical modifications to the

environment and, ultimately, to the resources necessary to sustain many species of frogs and reptiles. In addition to the reduction or elimination of critical resources, development for the tourist industry often entails bringing supplies (e.g., lumber, decorative plants) largely from the United States, mainland South America, or other islands, and non-native herpetofaunal species sometimes arrive with them as stowaways (e.g., Kraus 2009; Powell et al. 2011). For example, in recent years, *Anolis carolinensis* (native to the U.S.) has arrived on Anguilla, *A. sagrei* (native to Cuba and the Bahamas but very common in most of Florida) has become established on Grenada, St. Vincent, and St. Maarten, and *A. cristatellus* (native to the Puerto Rico Bank) has invaded the Dominican Republic

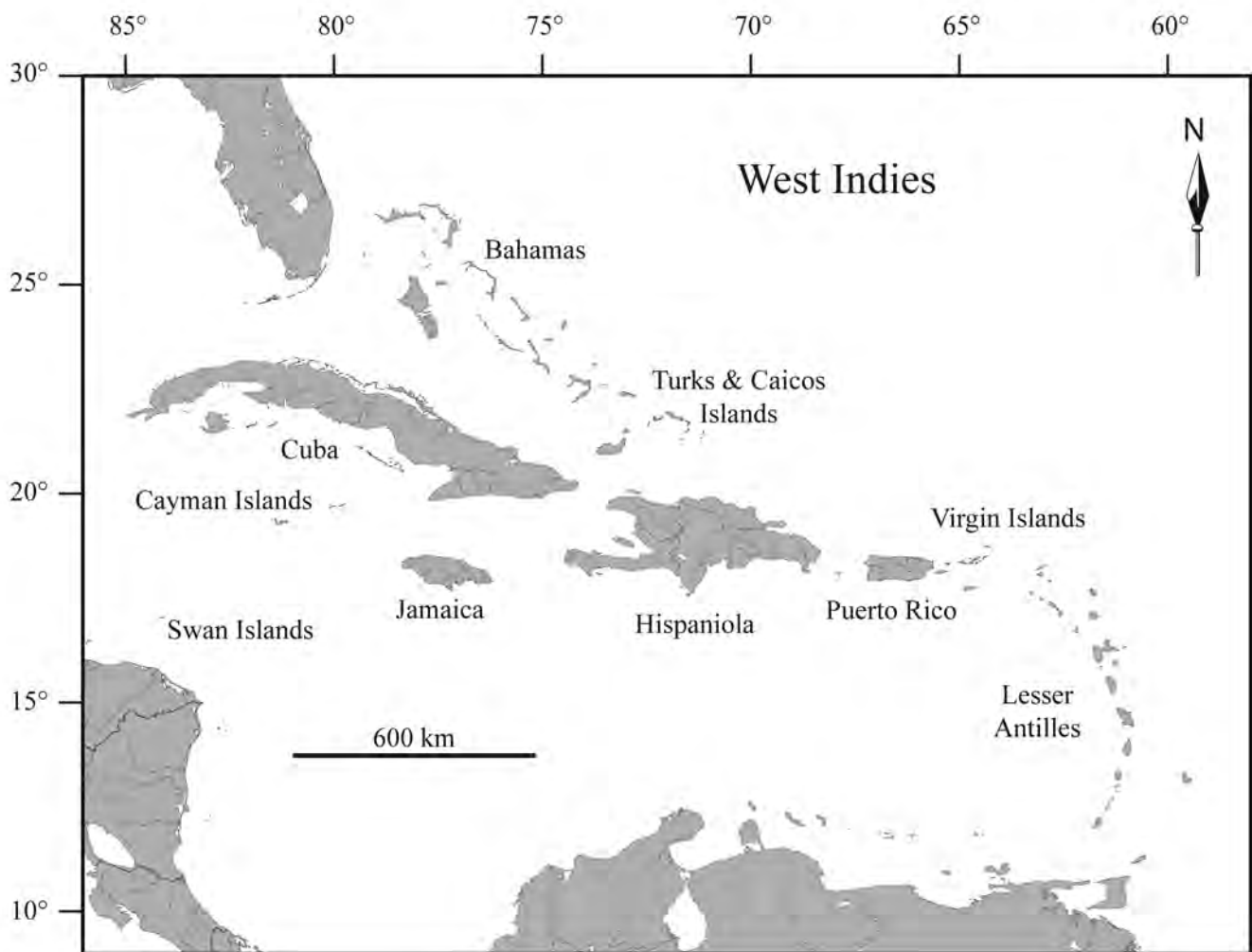


Figure 1. Major islands or islands groups of the West Indies used in this study.

and Dominica, and has been reported from St. Maarten. Similarly, the large Cuban treefrog, *Osteopilus septentrionalis*, has become established in the Virgin Islands and Lesser Antilles, and the snake, *Pantherophis guttatus* (native to the eastern U.S.), has been captured in the Bahamian Archipelago, the U.S. Virgin Islands, and several islands in the Lesser Antilles.

In collaboration with experts most familiar with specific areas within the West Indies, we set out to generate new island-by-island lists. Our reasons for doing so are fivefold: Since 1977, (1) we have found the (now outdated) island list by MacLean et al. to be a useful tool; (2) a great deal of new information on the distribution of amphibians and reptiles on West Indian islands has accumulated; (3) many new species of West Indian frogs and reptiles have been described; (4) several extirpations (or possible extinctions) have occurred; and (5) a number of species (mostly from the U.S.) have been introduced to West Indian islands and might ultimately have a deleterious impact on the native herpetofauna.

THE LISTS

We have defined the West Indies to include the Swan Islands, Cayman Islands, Bahama Islands, Greater Antilles (Cuba, Jamaica, Hispaniola, and Greater Puerto Rico), and Lesser Antilles (extending from Sombrero in the north to Grenada in the south). The following lists document more than 700 species of amphibians and reptiles that occur on over 700 islands. They are organized first by major island (e.g., Cuba) or island group (e.g., Lesser Antilles), then by island bank (e.g., Grenada Bank in the Lesser Antilles). These are listed in a roughly west-to-east fashion for the Greater Antilles and north-to-south for the Lesser Antilles. This geographic approach is largely retained for major islands or island groups within an island bank (defined for our purposes as a contiguous emergent land mass during the Pleistocene glacial maxima regardless of how many individual islands are extant today). Satellites to each of the major islands or within island groups are listed alphabetically to facilitate finding them in what are frequently long lists,

although this sometimes places geographically proximate islands far apart in the lists. We provide latitude and longitude for most islands (although rounding decimal degrees to the nearest hundredth will provide only an approximate location for many small cays). We also include area for most islands, and maps that illustrate the geographic relationships of major islands. Except for Cayo Arenas (Cayos Siete Hermanos, Hispaniola, which we have surveyed), we exclude islands for which no records exist, although we cannot, in most instances, distinguish between islands that have been surveyed without finding any resident species (e.g., Cayo Arenas) and those that have not been surveyed.

Records are based on museum vouchers and localities cited in the literature supplemented by the authors' observations and a few sightings by reliable witnesses. We generally follow the taxonomy provided on CaribHerp (Hedges 2012). Two notable exceptions are the inclusion of currently recognized subspecies (in order to enhance the utility of this list in case some of these are elevated to species in the future) and the choice not to elevate Bahamian subspecies of *Cyclura* to full species. Although we are inclined to believe that elevation is appropriate, that decision must be based on detailed genetic data that are not yet available; consequently, we take a conservative approach. We denote species that have been introduced to an island with an "(I)." We do not distinguish between newly introduced taxa and presumed reintroductions, mainly because the historical presence of some populations cannot be confirmed. Furthermore, the origins of some species cannot be established. Consequently, our annotations frequently are accompanied by question marks. For example, populations of *Chelonoidis carbonaria*, *Iguana iguana*, and human commensals like *Hemidactylus mabouia* on many, especially Lesser Antillean islands, likely are comprised of descendants of animals that arrived by natural means, descendants of individuals transported to the islands by the Amerindians who first colonized these islands some 7,000 years ago, and animals recently transported to the islands, either inadvertently accompanying shipments

of goods or intentionally as pets (e.g., Iverson 1978; Censky 1988; Greene et al. 2002; Powell et al. 2011). For *I. iguana*, we believe that we can with some accuracy distinguish natural (endemic) populations from those that are introduced, and we have marked them accordingly. For *C. carbonaria* and *H. mabouia*, we consistently use “(I?)” (except for two populations of the former that are known to be introduced by human agency in the British Virgin Islands and one of the latter that was recently introduced in the Turks and Caicos Islands), although we are sure that some populations, especially in the southern Lesser Antilles, arrived naturally and many, especially in the Greater Antilles, are almost certainly introduced. Also, *Rhinella marina* was intentionally introduced onto many West Indian islands (e.g., Lever 2003; Powell et al. 2011), but populations on some of the southern Lesser Antilles might have arrived by natural over-water dispersal (Henderson & Powell 2009). We mark the latter with “(I?).” Complicating matters even further are species that have been documented from islands but are not known to have established breeding populations. We have designated these as waifs and annotated such listings with a “(W)”; when we have data that suggest a population designated as a waif might be established, we mark these with a “(W?).”

Although documenting a negative is impossible, we have endeavored to identify populations that are believed to have been extirpated by marking them with a “(PX)” (= possibly or probably extirpated). Similarly, we have marked presumably extinct taxa with a “(PE)” (= possibly extinct). Taxa known from an island only from the fossil record are indicated with an “(F),” whereas extant taxa for which fossils are known are indicated with an “(F*).” We also considered attempts to document the conservation status of species (e.g., threatened or endangered), but ultimately chose not to do so, mainly because the status of many populations is uncertain and we did not want to imply that circumstances were less than critical by omitting annotations of status. For example, the status of most West Indian reptiles has not been assessed (e.g., Henderson & Powell 2009);

some species may have become extinct, some populations certainly have been extirpated, and many undoubtedly are threatened or endangered (e.g., Hedges 1999; Stuart et al. 2004; Henderson & Powell 2009; IUCN 2011) — but assessments on our part at this time would have to have been based almost entirely on circumstantial evidence, since detailed studies for most species are lacking.

Occasionally, records have been published about specimens or fossil remains (e.g., tortoises in the genus *Chelonoidis*) for which the species identity is unknown or uncertain. We have listed these accordingly (i.e., *Chelonoidis* sp.). Also, in a few instances, the assignment of a particular island population to species or (more commonly) subspecies is uncertain (e.g., *Celestus stenurus* ssp. on Île Grande Cayemite off Hispaniola) or an island population that is likely to represent a new species yet to be formally described (e.g., *Sphaerodactylus* sp. on Sombrero).

Until recently, the systematics of West Indian skinks has been problematic. Except for *Mabuya lineolatus* from Hispaniola and *M. macleani* from Carrot Rock, British Virgin Islands, relationships were poorly understood (e.g., Mayer & Lazell 2000). For most of the last century, all other island populations from the region had been assigned to *M. mabouya* (e.g., Dunn 1936; Schwartz & Henderson 1991). More recently, Henderson & Powell (2009) designated those populations as “*Mabuya* sp.” Herein we adopt the taxonomy of Hedges and Conn (2012), who recognized six genera (*Alinea*, *Capitellum*, *Copeoglossum*, *Mabuya*, *Marisora*, and *Spondylurus*) and 33 species in the West Indies, 16 of which are possibly extinct.

Certainly, like the ever-changing taxonomy, all of the data presented herein are inevitably subject to change as human populations continue to grow, habitats are increasingly altered, and new introductions of alien species occur — but also as new species are described and new populations are discovered. Much of the attraction for herpetologists working in the West Indies is the vast array of unanswered questions, the answers to many of which will undoubtedly elude us for generations to come.

ACKNOWLEDGMENTS

The Falconwood Foundation, through a grant to The Conservation Agency, provided financial support for this project. Recent West Indian field work of RWH has been generously funded by the Windway Foundation and the Milwaukee Public Museum, and that of RP by a series of National Science Foundation “Research Experiences for Undergraduates” grants and Avila University.

In addition to the contributors to this effort, we thank John S. Parmerlee, Jr. for providing maps

and the reviewers for helpful comments. Lourdes Rodríguez Schettino, editor of seminal works on the Cuban herpetofauna (1999; 2003), went well beyond the call of duty for reviewers by providing island sizes and current information, much of it unpublished, on the distribution of Cuban amphibians and reptiles.

Rose Henderson (1945–2012) accompanied her husband RWH during his first trips to the Lesser Antilles. We dedicate this publication to her memory.



Rose Henderson during an ascent of La Soufrière on Guadeloupe in 1987.

LITERATURE CITED

- Barbour, T. 1914. A contribution to the zoögeography of the West Indies, with especial reference to amphibians and reptiles. *Memoirs of the Museum of Comparative Zoölogy* 44:205–359.
- Barbour, T. 1930. A list of Antillean reptiles and amphibians. *Zoologica (N.Y.)* 11:61–116.
- Barbour, T. 1935. A second list of Antillean reptiles and amphibians. *Zoologica (N.Y.)* 19:77–141.
- Barbour, T. 1937. Third list of Antillean reptiles and amphibians. *Bulletin of the Museum of Comparative Zoölogy* 82:77–166.
- Censky, E. J. 1988. *Geochelone carbonaria* (Reptilia: Testudines) in the West Indies. *Florida Scientist* 50:108–114.
- Dunn, E. R. 1936. Notes on American mabuyas. *Proceedings of the Academy of Natural Sciences of Philadelphia* 87:533–557.
- Glor, R. E., & R. Laport. In press. Are subspecies of *Anolis* lizards (*A. distichus*) that differ in dewlap color and pattern also genetically distinct? A mitochondrial analysis. *Molecular Phylogenetics and Evolution* (doi:10.1016/j.ympev.2010.11.004).
- Greene, B. T., D. T. Yorks, J. S. Parmerlee, Jr., R. Powell, & R. W. Henderson. 2002. Discovery of *Anolis sagrei* in Grenada with comments on its potential impact on native anoles. *Caribbean Journal of Science* 38:270–272.
- Hedges, S. B. 1999. Distribution patterns of amphibians in the West Indies. Pp. 211–254 in W. E. Duellman, ed. *Patterns of Distribution of Amphibians: A Global Perspective*. Johns Hopkins University Press, Baltimore, Maryland.
- Hedges, S. B. 2012. *Caribherp: West Indian Amphibians and Reptiles* (<http://caribherp.org>). Pennsylvania State University, University Park.
- Hedges, S. B., & C. E. Conn. 2012. A new skink fauna from Caribbean islands (Squamata, Scincidae, *Mabuini*). *Zootaxa* 3228:1–244.
- Henderson, R. W., & R. Powell. 2001. Responses by the West Indian herpetofauna to human-influenced resources. *Caribbean Journal of Science* 37:41–54.
- Henderson, R. W., & R. Powell. 2005. Thomas Barbour and the Utowana voyages (1929–1934) in the West Indies. *Bonner Zoologische Beiträge* 52:297–309.
- Henderson, R. W., & R. Powell. 2009. *Natural History of West Indian Reptiles and Amphibians*. University Press of Florida, Gainesville, 496 p.
- IUCN (International Union for the Conservation of Nature and Natural Resources). 2011. 2011 IUCN Red List of Threatened Species. <www.iucnredlist.org>
- Iverson, J. B. 1978. The impact of feral cats and dogs on populations of the West Indian rock iguana, *Cyclura carinata*. *Biological Conservation* 14:63–73.
- Köhler, G., & M. Vesely. 2011. A new species of *Thecadactylus* from Sint Maarten, Lesser Antilles (Reptilia, Squamata, Gekkonidae). *ZooKeys* 118:97–107.
- Kraus, F. 2009. *Alien Reptiles and Amphibians: A Scientific Compendium and Analysis*. *Invading Nature: Springer Series in Invasion Biology* 4. Springer, New York, 563 p.
- Lever, C. 2003. *Naturalized Reptiles and Amphibians of the World*. Oxford University Press, New York, 318 p.
- MacLean, W. P., R. Kellner, & H. Dennis. 1977. Island lists of West Indian amphibians and reptiles. *Smithsonian Herpetological Information Service*(40:1–47).
- Mayer, G. C., & J. Lazell. 2000. A new species of *Mabuya* (Sauria: Scincidae) from the British Virgin Islands. *Proceedings of the Biological Society of Washington* 113:871–886.
- Myers, N., R. A. Mittermeier, C. G. Mittermeier, G. A. B. da Fonseca, & J. Kent. 2000. Biodiversity hotspots for conservation priorities. *Nature* 403:853–858.
- Ng, J., & R. E. Glor. 2011. Genetic differentiation among populations of a Hispaniolan trunk anole that exhibit geographical variation in dewlap colour. *Molecular Ecology* 20:4302–4317.
- Powell, R., & R. W. Henderson. 1999. Addenda to the checklist of West Indian amphibians and

- reptiles. *Herpetological Review* 30:137–139.
- Powell, R., & R. W. Henderson. 2003. A second set of addenda to the checklist of West Indian amphibians and reptiles. *Herpetological Review* 34:341–345.
- Powell, R., R. W. Henderson, K. Adler, & H. A. Dundee. 1996. An annotated checklist of West Indian amphibians and reptiles. Pp. 51–93 in R. Powell & R. W. Henderson, eds. *Contributions to West Indian Herpetology: A Tribute to Albert Schwartz*. Society for the Study of Amphibians and Reptiles Contributions to Herpetology, vol. 12. Ithaca, New York.
- Powell, R., R. W. Henderson, M. C. Farmer, M. Breuil, A. C. Echternacht, G. van Buurt, C. M. Romagosa, & G. Perry. 2011. Introduced amphibians and reptiles in the greater Caribbean: Patterns and conservation implications. Pp. 63–143 in A. Hailey, B. S. Wilson, & J. A. Horrocks, eds. *Conservation of Caribbean Island Herpetofaunas*. Volume 1: Conservation Biology and the Wider Caribbean. Brill, Leiden, The Netherlands.
- Pregill, G. K., & B. I. Crother. 1999. Ecological and historical biogeography. Pp. 335–356 in B. I. Crother, ed. *Caribbean Amphibians and Reptiles*. Academic Press, San Diego.
- Rodríguez Schettino, L. (ed.). 1999. *The Iguanid Lizards of Cuba*. University Press of Florida, Gainesville, 428 p.
- Rodríguez Schettino, L. (ed.). 2003. *Anfibios y Reptiles de Cuba*. UPC Print, Vaasa, Finland, 169 p.
- Schwartz, A., & R. W. Henderson. 1988. West Indian amphibians and reptiles: A check-list. *Milwaukee Public Museum Contributions in Biology and Geology* (74):1–264.
- Schwartz, A., & R. W. Henderson. 1991. *Amphibians and Reptiles of the West Indies: Descriptions, Distributions, and Natural History*. University of Florida Press, Gainesville, 720 p.
- Schwartz, A., & R. Thomas. 1975. A check-list of West Indian amphibians and reptiles. *Carnegie Museum of Natural History Special Publication* 1:1–216.
- Stuart, S. N., J. S. Chanson, N. A. Cox, B. E. Young, A. S. L. Rodrigues, D. L. Fischman, & R. W. Waller. 2004. Status and trends of amphibian declines and extinctions worldwide. *Science* 306:1783–1786.