The Biology of Chameleons

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Edited by KRYSTAL A. TOLLEY and ANTHONY HERREL

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Cover illustration: *Trioceros johnstoni* from the Rwenzori Mountains, Uganda. Photo by Michele Menegon.

CONTENTS

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FOREWORD

In putting together this book, we stand on the shoulders of others. The extensive bibliography presented here spans centuries, and the resulting body of literature is based on the work of researchers who dedicated their minds to a deeper understanding of chameleons. We have taken pieces of this great puzzle and have made a start at constructing the whole picture, but there are many glaring gaps. In some respects, it seems there are too many pieces missing and the emerging picture is only a hazy nebula of unclear, scattered, and fragmented bits. But the excitement that comes with the challenge of scientific thought, of asking the questions "why" and "how," is what compels us to keep looking for the missing pieces. For chameleons, the many missing pieces are the why and how of their remarkable evolutionary radiation, and we must keep questioning, even if we never complete the puzzle.

Although this book is built on the works of others, putting together this volume has been a group effort of the authors, all of whom enthusiastically came to the party. Each author brought their own expertise, and together we have made something more than any one of us could have done alone. It has been an extraordinary experience working with this team. As editors, we expected to be herding cats, but on the contrary, the process was surprisingly smooth. Of course, each of the chapters was reviewed by our peers, all of whom invariably provided positive and constructive criticism on the content. It is surprising how many things we missed initially, and we owe much to our colleagues for taking time to review and comment on these chapters: Salvidor Bailon, Bill Branch, Angus Carpenter, Jack Conrad, Frank Glaw, Rob James, Charles Klaver, Lance McBrayer, John Poynton, Phil Stark, Andrew Turner, James Vonesh, Bieke Vanhooydonck, and Martin Whiting. We are grateful to several friends and colleagues who permitted complimentary use of their photos, including Bill Branch, Marius Burger, Tania Fouche, Adnan Moussalli, Devi Stuart-Fox, and Michele Menegon. We also owe much to Chuck Crumly for eagerly taking on the initial responsibility of producing this book, as well as the National Research Foundation of South Africa and Centre National de la Recherche Scientifique and Groupement de Recherche

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TEN

Chameleon Conservation

RICHARD JENKINS, G. JOHN MEASEY, CHRISTOPHER V. ANDERSON, and KRYSTAL A. TOLLEY

Across the globe, species are in decline, primarily because of chronic degradation of primary habitat from anthropogenic activities (Myers et al., 2000; Mittermeier et al., 2004; Forister et al., 2010). The result is extensive habitat loss, and populations of some species are now undoubtedly smaller than at any time in their history. When such species are range-restricted and the rate of decline is rapid, the effects are compounded, leaving a distinct chance of extinction in the wild (Brooks et al., 2002; Thomas et al., 2004; Butchart et al., 2010). Chameleons are not exempt from these pressures, and a number of species are faced with severe declines.

Although some chameleons occur over relatively wide geographic areas, inhabit degraded and anthropogenically modified habitats, including urban sites, and appear to have few active threats, many other species are less resilient and suffer from the negative impacts of global change. The challenges facing chameleon conservation are, therefore, to understand the biology and distribution of each species, to know where direct and/or indirect threats are taking place, and to know how to counter these threats with effective conservation actions. With this information, the most threatened chameleon species can be identified and appropriate conservation actions planned and implemented. It is necessary, therefore, to understand the biology and assess the conservation status of the world's chameleons and the types of threats they face to facilitate the identification of species that are in most need of conservationists' attention.

10.1 CONSERVATION STATUS OF CHAMELEONS

To prioritize conservation actions, conservation status of chameleons must first be assessed using a standard procedure that is both transparent and uses the best available scientific information (Rodrigues et al., 2006). The IUCN Red List of Threatened Species™

(hereafter referred to as "IUCN Red List") is the international standard for assessing the extent to which species are facing extinction (Rodrigues et al., 2006). By categorizing species into different threat categories, the IUCN Red List provides a compendium of knowledge on status and biology, and is often the starting point for conservation action. Also, by tracking the conservation status of species over time, trends are revealed that indicate whether conservation efforts are effective. Thorough assessments of the conservation status of the world's mammal and amphibian species have been completed (Stuart et al., 2004; Hoffmann et al., 2010), but a similar initiative for the reptiles has yet to be finished (but see, Böhm et al., 2013).

Chameleons on the IUCN Red List

In this section, the conservation status of the 103 chameleon species, assessed for the IUCN Red List, is summarized (www.iucnredlist.org), followed by a broader discussion of all 196 chameleon species (described as of August 1, 2012), including those species yet to be assessed for the IUCN Red List. Most of the chameleon species assessed to date are native and endemic to the Indian Ocean islands of Madagascar (n = 76), Seychelles Archipelago [Mahé, Silhouette, and Praslin] (n = 1), Comoros Archipelago (Mayotte and Grand Comore; n = 2) and Socotra (n = 1). Assessments for only 22 species from mainland Africa (which is biased toward the South African *Bradypodion*) and one from the Arabian Peninsula were available. The IUCN Red List categorizes extant species into six categories of descending threat status from Critically Endangered, Endangered, Vulnerable, Near Threatened, and Least Concern, while the category of Data Deficient is used for taxa for which insufficient information is available to determine whether or not they are threatened (IUCN, 2012).

Four chameleon species are classed as Critically Endangered (Table 10.1), all of which are endemic to Madagascar, making them, to our knowledge, currently the most threatened chameleons in the world. These species typically occur over a very small geographic range and are in decline because of active threats that are reducing the size and suitability of the remaining habitats (Andreone et al., 2011,a–d). Two of the species (*Calumma tarzan* and *C. hafahafa*) inhabit humid forest in the east of Madagascar, while the others occur in drier areas in the west (*Brookesia bonsi*) and southwest (*Furcifer belalandaensis*).

There are 23 chameleon species in the Endangered category: 19 from Madagascar, one from the Seychelles, and three from mainland Africa. These face similar threats to Critically Endangered species but are considered less prone to extinction because they occur over a wider geographic area, or occur in more sites. All of the Endangered chameleons in Madagascar (*Brookesia,* 9 spp.; *Calumma,* 7 spp.; and *Furcifer,* 3 spp.) and can be broadly divided into those that are restricted to either the eastern humid or western dry deciduous forests. Species in the east can be categorized as associated with low elevation (*Calumma gallus* and *C. furcifer*), middle elevation (*B. ramanantsoai, C. globifer, C. glawi,* and *F. balteatus*), or montane humid forests (*B. karchei, B. bekolosy, C. hilleniusi,* and *C. andringitraense*). Many Endangered chameleons are also restricted to relatively isolated forest blocks, including all the western Endangered species (*B. dentata, B. decaryi, B. exarmarta, B. perarmata,* and *F. nicosiai*). In mainland Africa, *Rhampholeon spinosus* of the Usambara Mountains in eastern Tanzania inhabits humid forest, while the two Endangered South African species (*Bradypodion caffer* and *B. taeniabronchum*) occur in coastal forest and montane fynbos, respectively. *Archaius tigris,* which is also Endangered, occurs naturally on two islands in the Seychelles, where it inhabits humid forests.

There are also 21 chameleons on the IUCN Red List categorized as Vulnerable, 17 as Near Threatened, and 4 as Data Deficient. It is important to note that an additional 34 chameleon species on the Red List are widespread and not considered of conservation concern (Least Concern). Some of these taxa are also able to survive in human-modified landscapes, including gardens and farmland.

Perhaps the most startling information from this assessment is that 63% of the known chameleon species, for which assessments have been completed, are categorized as Threatened or Near Threatened (i.e., Critically Endangered, Endangered, Vulnerable, or Near Threatened). This compares with a global average of 23% for 867 species of lizards (Böhm et al., 2013). This dramatic, nearly threefold, difference may be because many of the species already assessed are from Madagascar (many of which have relatively small distributions). However, it appears likely that once all chameleons are assessed, their level of threat may be greater than that of other lizards. This may be because so many species inhabit tropical forests, which themselves are threatened habitats. Also, a number of species are endemic to small geographic areas, often single mountains, and this increases their likely extinction in the face of threats. Illegal, or unsustainable, collection is also a current or potential threat for many species.

During the assessment of all species for the IUCN Red List, assessors are asked to list all actual and perceived threats to each species; these were then placed into a categorization scheme, with a broad category encompassing major threats (Table 10.2). Although very few mainland African chameleons have been assessed, and these are mostly southern African *Bradypodion*, agriculture and the exploitation of biological resources are a threat to nearly all species. These threats mostly relate to the continued degradation of forest systems for agriculture (both subsistence and commercial) and harvesting (selective logging and general removal) of timber, which together with natural system modifications impact as habitat loss/modifications to chameleons. The impact of mining is prominent in Madagascar, while invasive species appear to affect more species in mainland Africa (with a bias to southern Africa). While the loss or modification of forests is clearly the main threat to chameleons, additional research is needed to determine the way in which the threat operates. The susceptibly of different chameleon species will depend on whether they occupy the canopy or ground layer, their feeding habits, and their reproductive behavior. For example, species that favor naturally open areas (e.g., rivers, edges and gaps) may tolerate modest levels of disturbance (e.g., Jenkins et al., 1999; Chapter 5).

To date, almost all chameleon assessments (90%) have used the Red List's B criterion, which means that the threat level depends on the known extent of occurrence (or area of occupancy—see IUCN, 2012, for detailed definitions) and ongoing threats to the habitat

TABLE 10.1 Summary of Chameleons on The IUCN Red List of Threatened Species as of 2011

Red List Category	No. of Species
Critically Endangered	4
Endangered	23
Vulnerable	21
Near Threatened	17
Least Concern	34
Data Deficient	4
Not Evaluated	93

TABLE 10.2 Major Threats to Chameleon Species for Which There Were Recorded Threats, Obtained from the IUCN Red List of Threatened Species.

The 103 species assessed are divided into mainland Africa (African) and Madagascar (Malagasy).

Major Threats	All Species	%	African	%	Malagasy	%
Residential and commercial development	5	5.2	2	9.1	3	4.1
Energy production and mining	11	11.5	2	9.1	9	12.2
Agriculture and aquaculture	82	85.4	14	63.6	68	91.9
Biological resource use	79	82.3	15	68.2	64	86.5
Invasive and other problematic species, genes and diseases	5	5.2	3	13.6	2	2.7
Natural system modifications	25	26.0	3	13.6	22	29.7
Total species with threats	96		22		74	

within that area. Although these same criteria have been used for most species of reptiles and amphibians on the Red List, they are based on minimal information of the actual species concerned. All other criteria (except D2) are based on population data, for which we are ignorant for most, if not all, species of chameleon. We do know whether the density of different species of chameleons varies within the same habitats (see Chapter 5), and for those that are rare, or at least seldom encountered, it is imperative that we start making estimates of population size and population viability in habitats that are under threat. To make meaningful assessments for species that are traded (see the section on "Trade in

Chameleons," below), we also require population-level data. Perhaps the most appropriate assessment would be based on C criteria from population viability analysis (PVA), which determines the probability that a species will go extinct in a given period of time, and as such is extremely useful in conservation. Most PVAs are based on demographic models of populations over a number of years (e.g., using annual Capture–Mark–Recapture studies), but these need to be carefully tailored to the unusual life cycle of some chameleons (e.g., Karsten et al. 2008; Chapter 5).

Chameleons Restricted to Single Sites

While a full assessment of extinction threats to chameleons is not possible until The IUCN Red List of Threatened Species includes all known species and appropriate supporting information, it is useful to identify taxa that are restricted to single localities, probably occur in small populations, and may be sensitive to external threats such as habitat loss. This information provides a provisional indication across all chameleons of species that may warrant greater conservation attention. There is considerable value in identifying the species that are "narrow endemics"—that is, those that occur at a single locality. This approach is exemplified by the Alliance for Zero Extinction (AZE; www.zeroextinction.org), which uses three criteria in site selection: (1) endangerment, (2) irreplaceability, and (3) discreteness. Because the first criterion requires a species to be listed as Endangered to Critically Endangered on the IUCN Red List, this criterion has not been applied here because many of the species have yet to be assessed. However, the latter two criteria can be applied to chameleons by identification of sites that have a discrete boundary and are the sole areas where the chameleon species occur. All chameleons that can be considered "trigger species"—that is, those restricted to single management area/site are evaluated here.

Information on the distribution of each chameleon species was obtained from the IUCN Red List of Threatened Species, and other reference materials (Spawls et al., 2004; Tolley and Burger, 2007; Menegon et al., 2009; Branch and Tolley, 2010; Glaw et al., 2012; Stipala et al., 2012). There are 42 chameleon species that are endemic to discrete, small, geographical areas. We found 22 from Madagascar and 20 from mainland Africa, from 31 different sites (Table 10.3). Most sites were in Madagascar (n = 13), followed by Kenya (n = 6), Tanzania (n = 5), Mozambique (n = 2), South Africa (n = 1), Cameroon (n = 1), Ethiopia (n = 1), Malawi (n = 1), and Sudan (n = 1). Eight of these sites are listed by AZE, based on the presence of other taxa (Table 10.3) but an additional three from Madagascar meet current criteria for chameleons and should be incorporated into future AZE updates. With the exception of three karst outcrops at Bemaraha, Namoroka, and Ankarafantsika National Parks, all the sites are in montane areas.

Only two of these AZE-based sites are not known to be formally protected (Table 10.3). However, as sites managed traditionally by communities, informally, or privately are not well presented in our analysis, it is important not to assume that these sites are less well protected, or managed, than those included in nationally recognized reserves. It is imperative that sites with the entire known global population of a chameleon species are

TABLE 10.3 List of Sites (Alphabetical by Country) That Contain the Entire Known Population of Individual Chameleon Species

Country	Site Name	Protection Level	Trigger Species (= species restricted to discrete management area)
Cameroon	Manengouba Mountains	None at present	*Trioceros perreti* (NE)
Ethiopia	Bale Mountains*	National Park	*Trioceros balebicornutus* (NE), *Trioceros harennae* (NE)
Kenya	Marasabit Mountain	National Park, National Reserve and Forest Reserve	*Trioceros marsabitensis* (NE)
	Mount Kenya*	National Park, Forest Reserve, UNESCO-MAB Biosphere Reserve	*Trioceros schubotzi* (NE)
	Mount Kulal	Forest Reserve, UNESCO-MAB Biosphere Reserve	*Trioceros narraioca* (NE)
	Kinangop Peak	National Park	*Trioceros kinangopensis* (NE)
	Mount Nyiro	Private Reserve	*Kinyongia asheorum* (NE)
	Mount Nyiru	Forest Reserve	*Trioceros ntunte* (NE)
Madagascar	Andohahela*	National Park	*Calumma capuroni* (VU)
	Ankarana	Special Reserve	*Brookesia confidens* (NE)
	Ankarafantsika*	National Park	*Brookesia decaryi* (EN), *Brookesia dentata* (EN)
	Bemanevika*	Protected area under creation	*Calumma hafahafa* (CR)
	Tsingy de Bemaraha*	National Park, Strict Nature Reserve, World Heritage Site	*Brookesia perarmata* (EN), *Furcifer nicosiai* (EN)
	Forêt d'Ambre*	Special Reserve	*Brookesia desperata* (NE)

TABLE 10.3 *(Continued)*

Country	Site Name	Protection Level	Trigger Species (= species restricted to discrete management area)
	Manongarivo**	Special Reserve	*Brookesia bekolosy* (EN)
	Marojejy**	National Park	*Brookesia karchei* (EN), *Calumma jejy* (VU) *Calumma peyrierasi* (VU)
	Montagne d'Ambre	National Park	*Brookesia ambreensis* (NT), *Brookesia antakarana* (NT), *Brookesia tuberculata* (VU), *Calumma amber* (NT), *Calumma ambreense* (NT)
	Montagne des Français	Protected area under creation	*Brookesia tristis* (NE)
	Nosy Hara	Protected area under creation	*Brookesia micra* (NE)
	Tsingy de Namoroka**	National Park	*Brookesia bonsi* (CR)
	Tsaratanana*	Strict Nature Reserve	*Brookesia lolontany* (NT), *Calumma tsaratananense* (VU)
Malawi	Mount Mulanje	Forest Reserve, UNESCO-MAB Biosphere Reserve	*Nadzikambia mlanjensis* (NE)
Mozambique	Gorongosa Mountain	National Park	*Rhampholeon gorongosae* (NE)
	Mount Mabu	None	*Nadzikambia baylissi* (NE)
South Africa	Ngome Forest	Wilderness Area	*Bradypodion ngomeense* (NE)
Sudan	Imatong Mountains	Nature Conservation Area	*Trioceros kinetensis* (NE)

(Continued)

TABLE 10.3 *(Continued)*

Country	Site Name	Protection Level	Trigger Species (= species restricted to discrete management area)
Tanzania	Mount Hanang	Forest Reserve	*Trioceros hanangensis* (NE)
	Nguru South Forest	Catchment Reserve	*Rhampholeon acuminatus* (NE)
	Sali	Forest Reserve	*Rhampholeon beraduccii* (NE)
	Uluguru Mountains*	Forest Reserve	*Kinyongia uluguruensis* (NE)
	Udzungwa Mountains	Forest Reserve, National Park	*Kinyongia magomberae* (NE)

SOURCE: Information on Protection Level was taken from the World Database on Protected Areas (www.protectedplanet.net in August 2012) and, for Madagascar only, the Atlas Numerique du Systeme des Aires Protégées de Madagascar (http://atlas.rebioma.net).

Note: Some sites are already included on the Alliance for Zero Extinction (AZE) because of the presence of other species (*), while others qualify under the three criteria AZE uses (**).

ABBREVIATIONS: CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; NE = Not Evaluated.

communicated to relevant stakeholders, including management authorities and community leaders. In many cases, it may be sufficient to communicate the information because the chameleons may not require any specific monitoring or management but would benefit from, or be threatened by, the ongoing conservation and disturbance at the site. In a few instances, which need to be identified, it is possible that the chameleons are subject to specific threats (e.g., wild harvesting or habitat loss) and require direct conservation action.

10.2 TRADE IN CHAMELEONS

All chameleon species belonging to the genera *Archaius, Bradypodion, Calumma, Chamaeleo, Furcifer, Kinyongia, Nadzikambia,* and *Trioceros* are currently included in the Appendix II of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES). Species of the genus *Brookesia* are also included in Appendix II of CITES, with the exception of *Brookesia perarmata,* which is in Appendix I (Carpenter and Robson, 2005). Of the *Rhampholeon* species, only *R. spinosus* is listed in Appendix II of CITES (because of its inclusion under its previous classification as a species of *Bradypodion*), while all other *Rhampholeon* species and all *Rieppeleon* species are not currently CITES listed. Species in Appendix II can be traded as long as it is nondetrimental to wild populations, while commercial trade is effectively prohibited for Appendix I species under normal circumstances.

Because chameleons are colorful and ornate, they attract considerable attention from hobbyists, and many species are traded across international borders in large quantities. The removal of chameleons from the wild can be illegal (e.g., inside a protected area or without permission) or legal but detrimental (unsustainable harvest levels), and CITES is an important mechanism for monitoring, which allows reporting that can influence trade and protection measures. Patterns in the quantity and composition of international chameleon trade, obtained from the CITES Trade Database at the United Nations Environment Programme—World Conservation Monitoring Centre (UNEP-WCMC), can provide important insights into commercial trends, infractions, and impacts of suspensions as well as highlighting potential cases of unsustainable trade (e.g., Carpenter et al., 2004, 2005).

To provide an up-to-date review of the trends in commercial chameleon trade, the data from the CITES Trade Database were downloaded (CITES, 2012a) and corrected to reflect current taxonomic nomenclature (e.g., *Archaius, Trioceros*). The trends were then summarized utilizing data on the quantity of live chameleons imported between 1977 (when CITES trade regulations were initiated) and 2010, from countries with native chameleon populations. Thus, these trends reflected the documented commercial trade in live chameleons using reported import quantities, rather than the quantity for which permits were requested, from countries where chameleons naturally occur.

These data show that between 1977 and 2010, more than 1.37 million chameleons have been exported and nearly one million of those were exported in the second half of that time range, from 1994 on (CITES, 2012a). In fact, since 1994, nearly 59,000 chameleons were

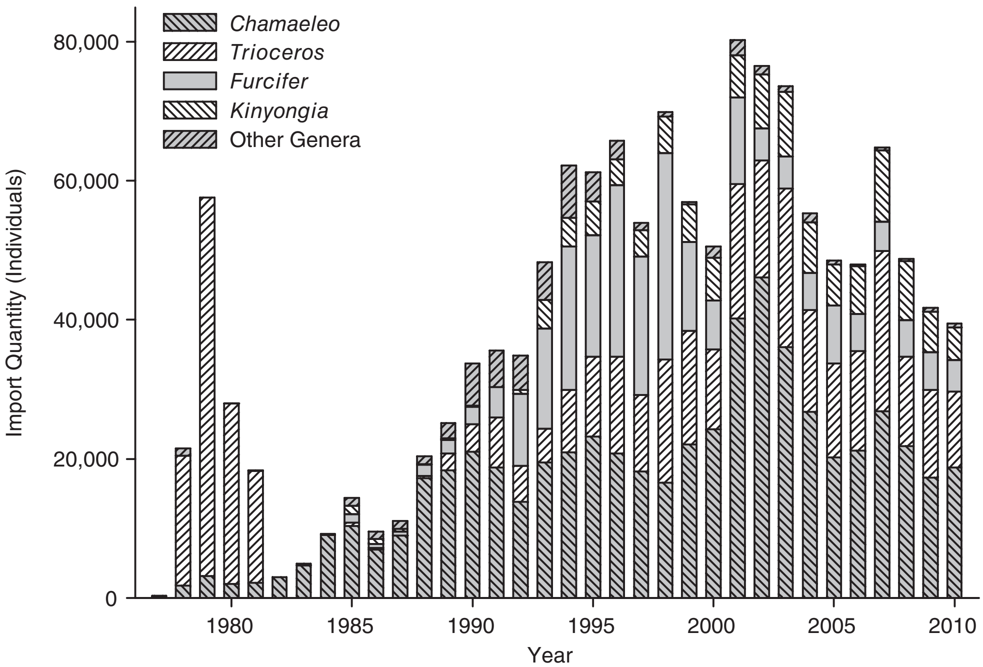

FIGURE 10.1. Annual chameleon exports from 1977 to 2010 by genus. Each bar represents the total export quantity for a year, subdivided to depict the proportion of the overall export quantity representing the top four chameleon genera exported over the period 1977 to 2010 (each genus designated by pattern).

exported annually from their countries of origin, with a high of more than 80,000 exported in 2001 alone.

The aggregated data show that the overall level of exportation of chameleons exhibits a bimodal distribution (Fig. 10.1) (CITES, 2012a), which is consistent with previously published studies (Carpenter et al., 2004, 2005). An initial spike in documented chameleon exports occurred between 1977 and 1981, when Kenya exported large numbers of *Trioceros* species prior to prohibiting the export of specimens caught in the wild. Following the sudden drop in exportation rates associated with the closure of Kenyan export of wild collected chameleons in 1981 (Carpenter et al., 2004), overall exportation rates climbed steadily until the mid-1990s when exportation rates began fluctuating year to year, but staying above 50,000 animals per year until 2005 (Fig. 10.1). Overall exportation rates remained relatively constant, from the mid-1990s through 2010, with a peak in annual export in 2001 (Fig. 10.1).

Chamaeleo species were exported in the highest numbers, followed by *Trioceros* and then *Furcifer* species (Table 10.4) (CITES, 2012a). Other genera, such as *Nadzikambia* and *Archaius*, were subject to little or no trade. It should be noted, however, that trade figures for *Rhampholeon* are limited to a single species, *Rhampholeon spinosus,* the only *Rhampholeon* listed by CITES, and thus no trade data are available for any other

TABLE 10.4 Total Live Chameleon Exports for Trade from 1977 to 2010 by Genus (Nonscientific/Zoological), by Absolute Quantity and Percentage of the Total Number Exported

Genus	Total Exported	%
Archaius	12	<0.001
Bradypodion	333	0.02
Brookesia	5,833[a]	0.4
Calumma	23,617	1.7
Chamaeleo	581,490	42.3
Furcifer	229,952	16.7
Kinyongia	113,367	8.3
Nadzikambia	0	0
Rhampholeon	?[b] (140[c])	? (0.01)
Rieppeleon	?[b]	?
Trioceros	392,509	28.6
"*Chamaeleo* spp." (Madagascar)	6,858	0.5
"*Chamaeleo* spp." (Mainland Africa)	19,525	1.4

a. Post-2003 data only.
b. CITES Trade Data lacking because of nonlisted status of genus.
c. CITES Trade Data for single species, *Rhampholeon spinosus*.

Rhampholeon or *Rieppeleon* species. Further, although trade data for *Brookesia* species are available for the period 1997 to 2010, trade data prior to the inclusion of this genus on CITES at the end of 2002 is incomplete (C. Anderson, personal observation). An example is *Brookesia perarmata,* a species endemic to Bemaraha National Park in western Madagascar, for which only 25 individuals were reportedly imported to the United States, all in 1997, but were observed for sale in far higher quantities during this period (C. Anderson, personal observation).

Accounting for more than a quarter of all imports from 1977 to 2010, *Chamaeleo senegalensis* remain the most traded chameleon species (Table 10.5), with sizable exports from Benin, Ghana, and Togo (CITES, 2012a; see also, Carpenter et al., 2004, 2005). This is followed by *Trioceros jacksonii* imports from countries where they are native (i.e., not including feral populations), which accounts for approximately 8.3% of total imports; however, more than 73% of that trade occurred prior to 1982, when Kenya was not restricting exports (Carpenter et al., 2004) and between 1990 and 2010, *T. jacksonii* was the ninth most traded species. From 1990 to 2010, *C. dilepis* was the second most exported chameleon, and it was third most since 1977. The majority of the 10 most traded species are the same when you consider the time period from 1977 to 2010 or from 1990 to 2010, however, *T. hoehnelii* is replaced on that list by *T. quadricornis* from 1990 to 2010.

Of the 10 most exported chameleon species from both aforementioned time periods (Table 10.5) (CITES, 2012a), 5 are listed as Least Concern on the IUCN Red List of Threatened Species (IUCN, 2012). *Chamaeleo gracilis, Trioceros jacksonii, T. melleri, Kinyongia*

TABLE 10.5 Top 10 Exported Chameleon Species from Native Countries of Origin from 1977 to 2010

Species	IUCN Red List	Total	%	Native Range
C. senegalensis	Least Concern	350,396	25.5	West Africa
T. jacksonii	Not Evaluated	114,511	8.3	Kenya and Tanzania
C. dilepis	Least Concern	108,214	7.9	Africa (Widespread)
C. gracilis	Not Evaluated	90,623	6.6	Africa (Widespread)
F. lateralis	Least Concern	82,957	6.0	Madagascar
F. pardalis	Least Concern	81,023	5.9	Madagascar
K. fischeri [a]	Not Evaluated	76,483	5.6	Tanzania
T. melleri	Not Evaluated	48,284	3.5	Tanzania, Mozambique and Malawi
T. hoehnelii	Least Concern	36,117	2.6	Kenya and Uganda
K. tavetana	Not Evaluated	33,904	2.5	Kenya and Tanzania

a. Includes *K. fischeri, K. matschiei, K. multituberculata, K. uluguruensis,* and *K. vosseleri.*

tavetana, T. quadricornis, and *K. fischeri* (for which CITES [2012a] Trade Data also includes *K. matschiei, K. multituberculata, K. uluguruensis,* and *K. vosseleri*); however, as with many other traded species, have not been assessed for The IUCN Red List (IUCN, 2012).

Chameleon Exports

Tanzania is the single largest exporter of chameleons, with over 345,000 recorded exports (Table 10.6, Fig. 10.2) (CITES, 2012a). Amazingly, almost 300,000 of those have been exported since 1996, and between 2004 and 2010, Tanzania alone exported an average 44% of the world's chameleons during that period (Fig. 10.2). Tanzania is followed by Togo (almost 284,000 individuals; Table 10.6) and Madagascar (almost 258,000 individuals; Table 10.6) as the largest exporter countries for chameleons. The height of Togo's chameleon exportation occurred between 1988 and 2003, but Togo's highest market share of chameleon exports occurred between 1982 and 1990, during which they accounted for 48 to 99% of the annual export (Fig. 10.2). Exportation levels for Togo, Benin, and Ghana may not be independent, however, as individual suppliers have been known to collect and export across these countries (A. Carpenter, personal communication). Peak exports from Madagascar occurred between 1992 and 1999, during which time Madagascar alone exported an average of 38% of the world's chameleons (Fig. 10.2). In 1994, however, the CITES secretariat requested that importing Party members suspend imports of all but four Malagasy *Chamaeleo* (now *Calumma* and *Furcifer*) species (Carpenter et al., 2004, 2005) and in 1999, Madagascar drastically cut annual export quotas of those four species, thus resulting in a decline in overall exports (Carpenter et al., 2005).

TABLE 10.6 Top 10 Native Chameleon Exporting Nations from 1977 to 2010

Country	Total Exported	Percentage
Tanzania	345,471	25.2
Togo	283,882	20.7
Madagascar	257,895	18.8
Kenya	128,501	9.4
Benin	80,275	5.8
Ghana	66,363	4.8
Cameroon	53,205	3.9
Burundi	38,919	2.8
Uganda	31,217	2.3
Equatorial Guinea	21,182	1.5

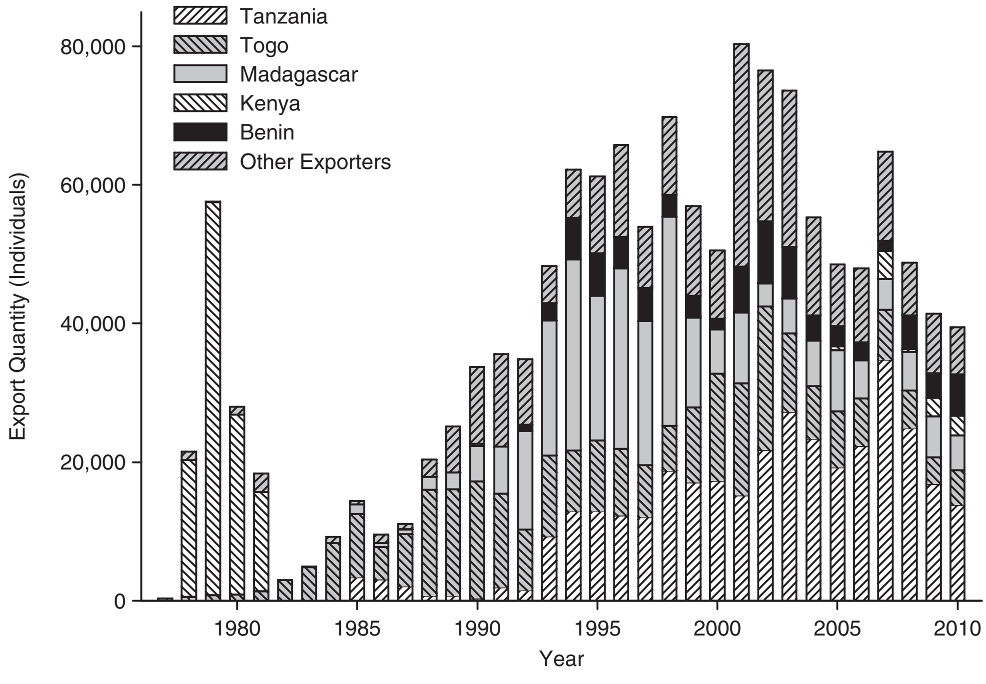

FIGURE 10.2. Annual chameleon exports from 1977 to 2010 based on actual import figures. Each bar represents the total export quantity for a year. Each bar is subdivided to depict the proportion of the overall export quantity exported by the top five chameleon-exporting nations over the period 1977 to 2010 and all other exporting nations.

Between 2001 and 2010, a number of other exporting countries notably increased their levels of exportation. Exports from Uganda, for instance, increased from less than 550 individuals exported between 1991 and 2000, to more than 30,600 individuals exported from 2001 to 2010. It should be noted, however, that 88% of that export volume occurred from 2001 to 2004 (CITES, 2012a). Other sizable increases in exportation include Benin (approximately 32,300 to 48,000 individuals), Jordan (70 individuals of one species to over 7200 of three species), Niger (no export to over 5250 individuals), and Mozambique (approximately 950 to 14,150 individuals). Kenya also saw an increase of exports, from 320 individuals to over 10,800, however, this increase was because of exports of chameleons reported on export documents to have been bred in captivity.

One increase in chameleon exportation is particularly noteworthy, however. Equatorial Guinea's export quantities increased from 4100 individuals from 1991 to 2000, to over 16,800 between 2001 and 2010 (CITES, 2012a). In fact, between 2004 and 2010, Equatorial Guinea was the sixth largest single exporter of chameleons, but 53% of the chameleons exported during that period were of species that are not known to occur within Equatorial Guinea (*Trioceros pfefferi, T. quadricornis,* and *T. wiedersheimi*). Despite the fact that these species do not occur in Equatorial Guinea, original CITES documents (as opposed to reexport documents) were issued for animals listed as caught in the wild, raising considerable concern about circumvention of international wildlife laws and management efforts.

Chameleon Imports

The United States is the single largest importer of chameleons, having imported more than 884,000 chameleons, or over 64% of all documented chameleon exports, between 1977 and 2010 (Table 10.7, Fig. 10.3) (CITES, 2012a). In fact, since 1978, the United States has imported less than 50% of all documented chameleon exports for a given year only four times, in 1984, 2003, 2009, and 2010 (Fig. 10.3). Europe as a whole has imported almost 26% of all documented chameleon exports with Asia as a whole accounting for only an additional 6.8% (Fig. 10.3). The overall global trends in chameleon exportation levels are, thus, highly correlated with that of the importation levels to the United States of America (Fig. 10.3).

Importation quantities between 2001 and 2010 to some countries have increased considerably as compared with quantities from 1991 to 2000. Ghana has emerged as a new import market, having no chameleon imports between 1991 and 2000 but almost 18,400 from 2001 to 2010 (CITES, 2012a). Germany also saw a considerable rise in imports (from approximately 16,000 to 56,400 individuals). Other sizable increases in importation include Canada (approximately 4200 to 8200 individuals), Japan (approximately 34,000 to 48,000), Mexico (20 to approximately 3600), and Thailand (approximately 100 to 3900). It should be noted, however, that importation to the United States between these two time periods declined from almost 361,000 to less than 332,000 individuals.

TABLE 10.7 Top 10 Chameleon-Importing Nations from 1977 to 2010

Country	Total Imported	Percentage
United States	884,276	64.4
Germany	111,324	8.1
Japan	84,607	6.2
Netherlands	61,087	4.4
Spain	43,061	3.1
France	37,588	2.7
Belgium	35,183	2.6
United Kingdom	32,019	2.3
Ghana	18,398	1.3
Canada	12,589	0.9

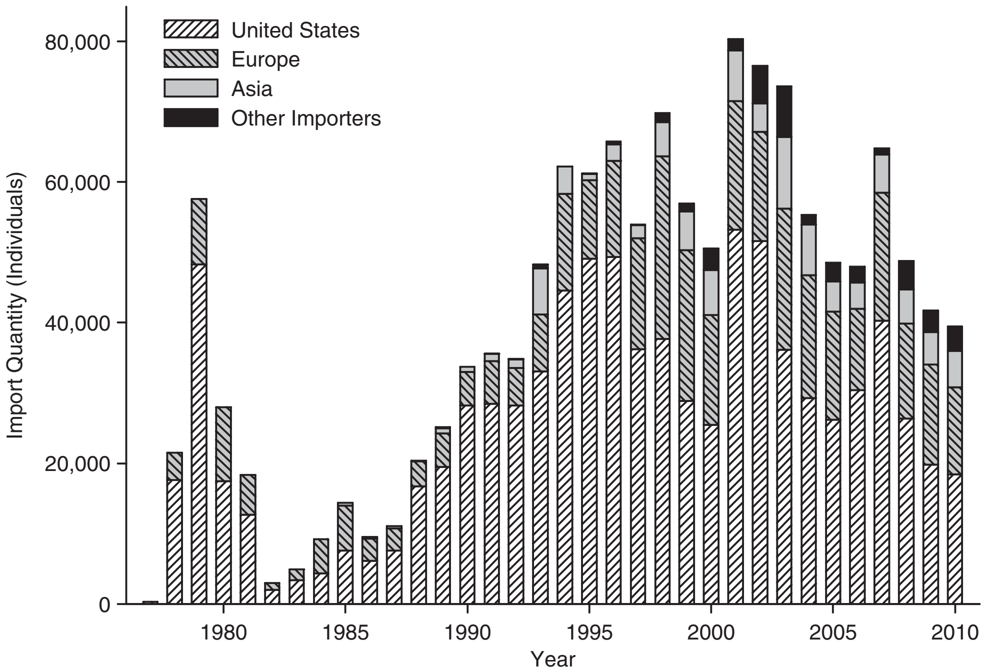

FIGURE 10.3. Annual chameleon imports from 1977 to 2010 broken up into major importing regions or nations. Each bar represents the total import quantity for a year. Each bar is subdivided to depict the proportion of the overall export quantity imported by the United States (the top overall importer of chameleons), Europe, Asia, and all other importing nations.

Wild Caught versus Captive Bred

Of all chameleon species in the trade, relatively few are reliably produced in captivity in any significant quantity and those that are imported as wild-caught individuals frequently have high mortality rates during transit (Abate, 2001; C. Anderson, personal observation). Because many wild-caught species are exported in such large quantities every year, many of these have become species with which exporters fill shipments in order to increase the overall shipment size and value (C. Anderson, personal observation). They are sent in large quantities at a very low price per individual. This low price results in a minimal mark-up by the exporter, and a thin profit margin means the animals are not worth the effort to care for as well as the more valuable animals are. The importer then gets large shipments of these species in an already compromised condition. In order to move their inventory of these animals, the importers sell them as quickly as possible at a very small mark-up (Abate, 2001; C. Anderson, personal observation). The result is that these species end up at pet shops in a severely compromised condition. They are then sold retail as quickly as possible for low amounts (as low as $15 or less for *Chamaeleo senegalensis*; C. Anderson, personal observation) and often die in a matter of weeks to months. This trend is further bolstered by the export of large numbers of adult animals, which tend to be more difficult to acclimate to captivity than juveniles.

Unfortunately, because these animals are available for retail sale in such large numbers and at such low prices, there is limited means for anyone interested in these species to make a profit breeding that species in captivity (C. Anderson, personal observation). Even people who are genuinely interested in breeding any of these species in captivity thus tend to give up their efforts quickly because the market is flooded with underpriced alternatives and coming anywhere close to covering their costs is an unobtainable goal.

The entire dynamic of the trade changes, however, in species with annual importations of more modest numbers of individuals. In these cases, the market is no longer flooded and anyone working to propagate that species in captivity is able to sell their offspring at prices that more accurately reflect the expense of producing these animals in captivity. The wild-caught imports that are still available then become valuable animals to infuse into captive breeding groups, with breeders being willing to pay more for animals that are healthier and have a better chance of acclimating successfully and adding to their breeding efforts. This causes the importers to value the condition of these animals, meaning they take better care of them so they can mark them up more. As a result, they demand higher-quality specimens of these species from their exporters, who are then inclined to take better care of these animals because they too can ask more per individual and able to export fewer individuals.

For instance, while *F. pardalis* is the sixth most exported chameleon species, the average number of specimens exported every year dropped by 75% from the period 1991–2001 to the period 2002–2010, resulting in a considerable reduction in the number of imported specimens available in the trade in recent years. The increased exportation rate of *F. pardalis* in the earlier period resulted in great availability of wild-caught imports on the market for relatively low prices—prices that were often lower than the price of captive-bred animals. Following the reduction in annual export quotas for this species, however, interest in breeding this species in captivity increased, causing wild-caught imports to be sought out by breeders to infuse new bloodlines into their breeding groups. At present, these wild-caught imports are frequently more expensive than the captive-bred animals produced later. The result has been that the quality of animals exported has increased and the proportion of individuals that survive once in captivity has increased as well.

Overall, CITES trade data from all exporting countries (as opposed to data limited to exporting countries with native chameleons) indicates that a total of 136,294 captive-bred chameleons were imported between 1985 and 2010 (CITES, 2012a). Of that number, 95% were imported between 1996 and 2010 and 85% in the last 10 years of this time period, indicating a significant increase in the supply of captive-bred species. Sixty-six percent of captive-bred imports were *Chamaeleo calyptratus*. *Furcifer pardalis* makes up the next largest proportion of captive-bred imports, at approximately 11,800 individuals. Slovakia is the largest exporter of captive-bred chameleons, with 26% of all exports (approximately 35,700 individuals), followed by the Ukraine (approximately 21,500 individuals) and the Czech Republic (approximately 18,500 individuals). The United States is the single largest importer of captive-bred chameleons, with 35% of all imports (approximately 47,500 individuals), followed by Japan (approximately 23,000 individuals), and Canada (approximately 10,000 individuals). It should be noted, however, that feral populations of *F. oustaleti*, *C. calyptratus* and *Trioceros jacksonii xantholophus* in the United States is also known to offset a considerable amount of the domestic demand for these species (C. Anderson, personal observation).

Sustainable Trade

The basic tenet of CITES is that international trade in species should be benign to wild populations. The Antsingy Leaf Chameleon (*Brookesia perarmata*) is the only chameleon in Appendix I, but all other CITES-listed chameleons are in Appendix II, which has different mechanisms for managing and monitoring trade. The Significant Trade Review allows CITES to review trade in Appendix-II species in order to identify species for which trade appears to be unsustainable and to recommend remedial actions. In cases in which unsustainable trade is suspected, detailed recommendations aimed at specific Parties are made, with failure to comply likely to lead to a suspension of imports of the species in question. Parties are expected, when called upon by CITES, to demonstrate that collection and export is nondetrimental to wild populations. This is challenging for many Parties, especially those lacking sufficient resources. Carpenter et al. (2005) described the impact on livelihoods, markets and the composition of exports following the 1994 suspension of all Malagasy *Calumma* and all but four *Furcifer* species. As a more up-to-date example, in July 2012 CITES suspended imports of *Trioceros feae* because Equatorial Guinea failed to comply with recommendations made through the Significant Trade Review process.

The wider debate on the impact of trade in chameleons in general is hampered by a lack of information. While Parties are rightly permitted to export species regardless of their IUCN Red List status, taxa that are considered a conservation priority (e.g., Critically Endangered and Endangered) quickly become the focus of attention, especially when export levels appear "high." This can eventually lead to the involvement of the CITES Standing Committee, which may enforce trade suspensions in cases in which Parties are unable to provide convincing evidence that exports of threatened taxa are nondetrimental to wild populations. When considering the likely impact of collection on a species, two important considerations need to be taken into account: (1) the proportion of the species' range over which collection can legally occur and (2) the level and intensity of collection. Put simply, collection outside of protected areas in scattered geographical localities might be preferred for many species. When species are restricted in range, like *Kinyongia fischeri,* even modest collection levels may be harmful. It is noteworthy that this species and *K. tavetana* entered the CITES Significant Trade Process in 2012 because of concerns regarding the potential impact of trade on wild populations. Both species are among the top ten most exported chameleons (Table 10.5).

Annual export quotas are set by individual countries to limit the number of animals exported to sustainable levels. Eleven countries, all from Africa, have used quotas to manage their chameleon exports in the last 10 years (Table 10.8). All countries set export quotas for wild-caught chameleons and three set export quotas for ranched chameleons.

Illegal Trade

A complicating factor of limiting legal trade, unfortunately, is a surge in illegal trade if demand significantly exceeds legal trade limits. These illegal markets are obvious in the extensive captive trade of South African *Bradypodion* species and of Malagasy *Calumma* and *Furcifer* species (excluding *F. pardalis, F. lateralis, F. oustaleti,* and *F. verrucosus*) worldwide, but particularly in Europe (Anderson, personal observation). The nature of this illegal trade takes various forms but includes the open trading of species that have never been legally exported under CITES (e.g., *Bradypodion setaroi*; CITES, 2012a; C. Anderson, personal observation), the importation of species with forged CITES documents that were not issued by the CITES Management Authority of the exporting country (i.e., Cameroon; CITES, 2012b), the mass issuance of CITES documents and subsequent exportation of species from countries where they do not naturally occur (e.g., *Trioceros pfefferi, T. quadricornis,* and *T. wiedersheimi* export from Equatorial Guinea; CITES, 2012a), or the availability of species that have been banned from export for more than 15 years (Carpenter et al., 2004, 2005) and never successfully propagated in captivity in sustainable numbers (e.g., *C. gallus* and *F. antimena*; C. Anderson, personal observation).

One reason many of these species are traded in the open market is the inability of authorities to verify whether or not specimens that are currently in captivity are of legal origin. Because any captive-bred descendants of CITES-listed specimens that were acquired and imported legally are themselves legal, enforcement issues generally require authorities

TABLE 10.8 Summary of Summed Annual Export Quotas Used by 11 African Countries between 2003 and 2012

Country	Wild	Ranched/F1	Total Export Quota
Benin	3,600	104,600	108,200
Cameroon	9,000	0	9,000
Chad	4,000	0	4,000
DRC	106,000	0	106,000
Ethiopia	100,200	0	100,200
Ghana	21,000	0	21,000
Madagascar	84,800	0	84,800
Mozambique	42,000	0	42,000
Niger	39,000	0	39,000
Togo	55,000	85,000	140,000
United Republic of Tanzania	178,000	20,032	198,032

be able to prove that an animal is not a descendant of legally acquired and imported specimens or was not itself legally acquired and imported (Todd, 2011). This is exceedingly difficult because traders can falsely declare specimens as the direct descendants of specimens on old CITES documents from previous legal shipments of that species (Todd, 2011). Smuggled chameleons, or the progeny of smuggled chameleons, can therefore be laundered through and "legal" CITES export documents acquired by almost anyone who has ever acquired legal specimens of that species with little ability from the authorities to prove otherwise unless they are caught in the act of smuggling itself (Todd, 2011). Some countries (e.g., Thailand) have become hotbeds of such laundering operations (Todd, 2011).

10.3 CHAMELEONS AND GLOBAL CHANGE

The world's climate has already warmed by 0.6°C over the past 100 years, and the warming trend is set to continue. Although anthropogenic climate change is often generalized as "global warming," models of future climate suggest far more complex scenarios, including changes in diurnal temperature range, cloud cover, and precipitation and their consequent interactions (Adler et al., 2008; Zhou et al., 2009). Of particular note is an increase in the expected frequency of extreme weather events, such as heat waves, droughts, floods, storms, and cyclones (IPCC, 2011), which may result in disturbance to many ecosystems. For example, Malagasy forests are expected to be negatively affected by an increasing frequency of El Niño events associated with climate change (Ingram and Dawson, 2005).

After habitat destruction, climate change is one of the most serious and widespread threats to biological diversity (IPCC, 2007). Although extant species have undergone significant climatic change in their past, these changes have occurred at a much slower rate, allowing for both extinction and speciation processes (Chapter 7). In addition, many species are under a high degree of threat because of anthropogenic changes to their habitats, so that climate change is acting as an added stressor. In broad terms, climate change has been shown to have effects on the abundance, distribution, and phenology of species, although many studies are suggesting that it is the complex interaction of these changes together with other stressors that can produce devastating impacts on species. For example, climatic warming is hypothesized as acting synergistically with a novel pathogenic fungus to cause extinction and declines of multiple frog species in Central America (Pounds et al., 2006). Fungi and other infectious diseases have been highlighted as potential causes of future biodiversity loss, with climatic changes as a potent cofactor (Fisher et al., 2012).

Although very few studies have addressed the influence of climate change directly on chameleons, there are some general patterns emerging from studies on lizards that can aid in producing an overview. Ectotherms are thought to be particularly vulnerable to thermal climatic changes because of their direct dependence on external heat sources. This is especially true of topical ectotherms, which are intolerant of high temperatures as well as being sensitive to temperature change. In a comparative, macrophysiological analysis, Huey et al. (2009) showed that lowland lizards living in neotropical forests are at a heightened risk from climatic warming. In Mexico, a study showed that increases in air temperature caused lizards to spend more time in the shade to avoid surpassing thermal maxima (Sinervo et al., 2010). This resulted in less foraging time, with the greatest effect observed during their spring breeding season. In another study on temperate lizards, Massot et al. (2008) showed that increasing spring temperatures were coupled with a decrease in juvenile dispersal. Thus, species with low dispersal ability and geographic barriers to movement are likely to be at an increased risk of extinction. The relationships between ambient temperature, which affect lizard fitness through performance (critical thermal maximum and the thermal optimum; Chapter 3), are crucial in our understanding of future environmental changes. Clusella-Trullas et al. (2011) suggested that as temperature variation and precipitation regimes are likely to have been influential in the evolution of lizard performance, predicting future scenarios will rely on these factors in addition to average temperature. The effects of climate on the predators and (mainly) invertebrate prey items of chameleons are as yet unknown. There is a potential to alter timing of both activity period and breeding success, but as yet there are no studies that have attempted to quantify such effects.

For chameleons that breed year round (Chapter 5), changes in climate are unlikely to impact on phenology as they are likely to be able to take advantage of any favorable climatic periods. However, some chameleons are known to have annual life-history traits that are linked to particular climatic events, such as the onset of a rainy season or the change in nest temperatures associated with hatching times (Karsten et al., 2008, Box 5.1). In future scenarios in which extreme weather events fall out of these seasons, or weather patterns generally become unpredictable, this could result in the loss of recruitment for an entire season. It is also possible that changes in ambient temperature during embryogenesis have unexpected effects.

Many studies have used species distribution models to forecast future distributions under different climatic scenarios. Such studies are strongly dependent on the predictive models used, and these are constantly being improved. Existing studies are useful, however, in that they provide a range of scenarios showing differential responses of a range of species. Houniet et al. (2009) reported a range of responses for *Bradypodion* chameleons from projecting distribution models into IPCC climate scenarios for 2080. While most species were predicted to contract their range, one species (*B. transvaalense*) displayed a shift southward, together with range contraction. In Spain, Moreno-Rueda et al. (2011) predicted a northward shift for *Chamaeleo chamaeleon*. Predictions of shifting ranges are then dependent on the dispersal ability of a particular species, coupled with the availability of appropriate habitat to move to and appropriate corridors to disperse through.

Montane species are particularly vulnerable (cf. Janzen, 1967) because of the upslope distribution displacements that occur when cold-adapted species are forced upward in the face of rising temperatures. These typically montane species may eventually run out of sufficiently cool climate to move to and may be forced into extinction. Although the most frequently cited case for this phenomenon is the extinction of a Central American frog, the same study also showed population crashes in arboreal anoline lizards (Pounds et al., 1999). Raxworthy et al. (2008) made a study of changes in minimum altitude of herpetofauna on Tsaratanana Mountain in central Madagascar. Their study included six chameleons, one of which (*Calumma malthe*) was found to display upslope displacement (increasing both minimum and maximum altitudes) over a 10-year period (between 1993 and 2003). Clearly, there are many other examples of chameleons that could be victims of upslope displacement, in the mountains of East and West Africa, as well as in Madagascar, where there are 35 species of *Calumma,* which are endemic to zones within 600 m of mountain summits (Raxworthy and Nussbaum, 2006).

Chameleons are not typical lizards (Chapter 1), and we may not be able to generalize on the effects of climatic change from studies on other lizards groups. For example, if climate change is expected to play a key role in lizard performance, should we expect slow-moving chameleons to be affected? On the other hand, their slow nature may make them less able to disperse and move to areas of more appropriate habitat. Chameleons appear to be unaffected by temperature-dependent sex determination (Andrews, 2005), which affects the majority of reptile species, but they do have unique embryogenic systems that may put them at increased risk (Chapter 5). In order to understand how future climate scenarios are likely to affect this unique family of lizards, researchers will have to understand more of how their ecology and physiology are influenced by climatic variables. It is also important to recognize that some species may benefit from newly disturbed habitats because of extreme weather events, while others have increased risk as they are already under the influence of extreme climatic constraints or narrow environmental niches. A preliminary step may be to identify species that could have an increased risk and for which research could concentrate.

The effects of climate change are difficult to predict, but over the long term, there is little doubt that human-induced climate change will impact our environment. In contrast, habitat loss is the greatest immediate and acute threat to biodiversity globally (Myers et al., 2000; Butchart et al., 2010). Many chameleons have restricted distributions (Chapter 7), and some are endemic to a single forest (e.g., *Bradypodion ngomeense*, *Brookesia micra, Kinyongia magomberae*) or locality (Table 10.3). In addition, chameleons are habitat-specific and adapted to certain types of vegetation (Chapters 5 and 7). These factors make it unlikely that chameleons can cope well with habitat destruction, alteration, and fragmentation. Although there are a few species that appear to succeed in altered landscapes (e.g., *K. boehmei* in subsistence shambas, *Bradypodion pumilum* and *Bradypodion damaranum* in urban gardens, and *Furcifer lateralis* in disturbed environments) the vegetation structure in transformed settings is probably similar in some way to that of their natural environment, allowing them to endure. These examples should be considered the exception, rather than the rule.

It is not surprising that areas that retain the greatest diversity in Africa are also those under the greatest pressure for habitat alteration (Myers et al., 2000; Burgess et al., 2007; Fjeldså and Burgess, 2008; Hall et al., 2009; Menegon et al., 2008, 2011; Williams, 2012). Indeed, population density and growth are positively correlated with species richness and endemism in top global biodiversity hotspots (Cincotta et al., 2000; Balmford et al., 2001; McKee et al., 2004; Jha and Bawa, 2006). In Africa, areas that have high numbers of chameleon species are in the same regions where human influence on the landscape is pronounced (Fig. 10.4). Three areas of Africa are notable for chameleon diversity—Madagascar, the Eastern Arc Mountains, and the Guinea–Congolian highland forests (Chapter 7). Not surprisingly, population growth in the Eastern Arc region has increased by 24% in the past decade and human population density has reached more than 80 people/km^2. Although the density is lower in Madagascar (43 per km^2), the growth is faster, with the population having increased by 35% in the past decade. Population in the Guinea–Congolian hotspot, which encompasses the highland forests, is growing at twice the global average and now stands at more than 165 per km^2 (Williams, 2012). Population growth globally is straining our limited resources and advancing the degradation of the environment worldwide. Yet these hotspots are reservoirs of our biodiversity, and they are bearing the brunt of direct effects on habitat and ultimately species, such as chameleons.

10.4 THE WAY FORWARD

Conservation of the world's chameleons will rely heavily on our ability to generate sufficient data on biological/environmental requirements, threats, and their effects on populations over the next 20 years. Although provisional, current information suggests that chameleons may face a higher level of threats than reptiles in general, in part because of ongoing trade, but also because of restricted distributions in dwindling forested habitat of the tropics. Although we are poorly informed about how current populations of chameleons can be conserved, we are completely ignorant of what the effects of climate change might bring to these unusual arboreal lizards. In order to change this, we need physiological studies that can help inform us, as well as better models incorporating these data and more, surpassing the current species distributions models with mechanistic models (cf. Kearney and Porter, 2009) for the effects of climate change on chameleons.

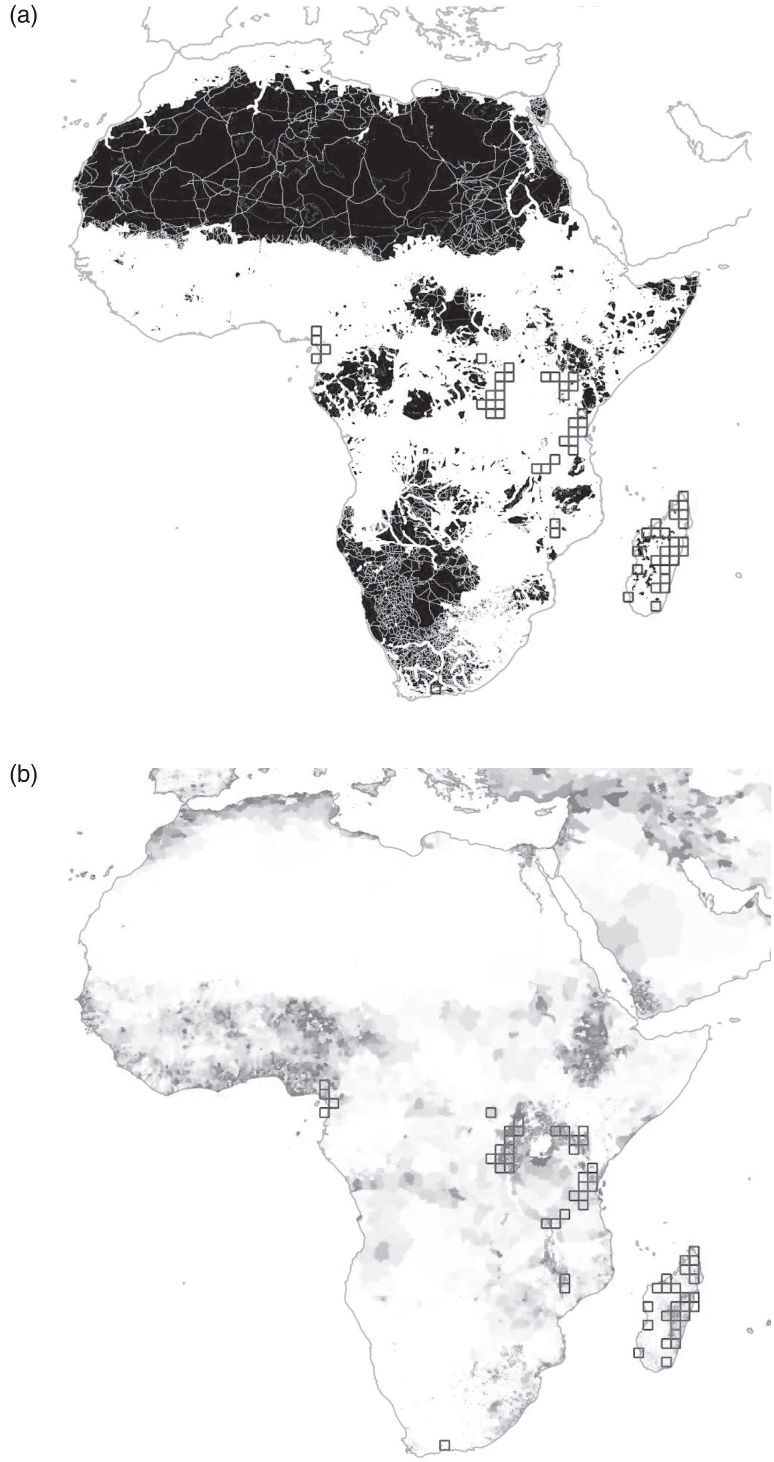

FIGURE 10.4. (a) Human influence in Africa is shown in shades from light (more impact) to dark (less impact), and (b) human population density in light (low density) to dark (high density). Both maps are superimposed with those 1-degree grid cells where high numbers of chameleon species occur. Particularly noteworthy is that in areas with high numbers of species, human influence and population density are also high. Human influence and population density maps obtained from Socioeconomic Data and Applications Center (SEDAC), http://sedac.ciesin.columbia.edu/wildareas/.

While it is hoped that IUCN Red List assessments will be made for all chameleon species in the near future, there is much more work to be undertaken in terms of gathering population/behavioral ecological data on the most threatened species. Chameleon conservation would also benefit from work focused on how global change (climate change and habitat alternation) affects chameleon populations. Furthermore, studies that focus on gathering data pertaining to chameleon population trends for species under trade would ensure confidence in non-detriment findings" (which provide justification that collection and trade does not negatively impact wild populations) and improve CITES regulations for chameleons.

ACKNOWLEDGMENTS

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List of 196 Described Chameleon Species as of 2012, with the Broad Region in Which They Occur

Species	Region
Archaius tigris (Kuhl, 1820)	Seychelles
Bradypodion atromontanum Branch, Tolley, and Tilbury, 2006	Southern Africa
Bradypodion caeruleogula Raw and Brothers, 2008	Southern Africa
Bradypodion caffer (Boettger, 1889)	Southern Africa
Bradypodion damaranum (Boulenger, 1887)	Southern Africa
Bradypodion dracomontanum Raw, 1976	Southern Africa
Bradypodion gutturale (Smith, 1849)	Southern Africa
Bradypodion kentanicum (Hewitt, 1935)	Southern Africa
Bradypodion melanocephalum (Gray, 1865)	Southern Africa
Bradypodion nemorale Raw, 1978	Southern Africa
Bradypodion ngomeense Tilbury and Tolley, 2009	Southern Africa
Bradypodion occidentale (Hewitt, 1935)	Southern Africa
Bradypodion pumilum (Gmelin, 1789)	Southern Africa
Bradypodion setaroi Raw, 1976	Southern Africa
Bradypodion taeniabronchum (Smith, 1831)	Southern Africa
Bradypodion thamnobates Raw, 1976	Southern Africa
Bradypodion transvaalense (Fitzsimons, 1930)	Southern Africa
Bradypodion ventrale (Gray, 1845)	Southern Africa
Brookesia ambreensis Raxworthy and Nussbaum, 1995	Madagascar
Brookesia antakarana Raxworthy and Nussbaum, 1995	Madagascar
Brookesia bekolosy Raxworthy and Nussbaum, 1995	Madagascar
Brookesia betschi Brygoo, Blanc, and Domergue, 1974	Madagascar
Brookesia bonsi Ramanantsoa, 1980	Madagascar
Brookesia brygooi Raxworthy and Nussbaum, 1995	Madagascar
Brookesia brunoi Crottini, Miralles, Glaw, Harris, Lima, and Vences, 2012	Madagascar
Brookesia confidens Glaw, Köhler, Townsend, and Vences, 2012	Madagascar
Brookesia decaryi Angel, 1939	Madagascar
Brookesia dentata Mocquard, 1900	Madagascar
Brookesia desperata Glaw, Köhler, Townsend, and Vences, 2012	Madagascar

(Continued)

Species	Region
Brookesia ebenaui (Boettger, 1880)	Madagascar
Brookesia exarmata Schimmenti and Jesu, 1996	Madagascar
Brookesia griveaudi Brygoo, Blanc, and Domergue, 1974	Madagascar
Brookesia karchei Brygoo, Blanc, and Domergue, 1970	Madagascar
Brookesia lambertoni Brygoo and Domergue, 1970	Madagascar
Brookesia lineata Raxworthy and Nussbaum, 1995	Madagascar
Brookesia lolontany Raxworthy and Nussbaum, 1995	Madagascar
Brookesia micra , 2012	Madagascar
Brookesia minima Boettger, 1893	Madagascar
Brookesia nasus Boulenger, 1887	Madagascar
Brookesia perarmata (Angel, 1933)	Madagascar
Brookesia peyrierasi Brygoo and Domergue, 1974	Madagascar
Brookesia ramanantsoai Brygoo and Domergue, 1975	Madagascar
Brookesia stumpffi Boettger, 1894	Madagascar
Brookesia superciliaris (Kuhl, 1820)	Madagascar
Brookesia therezieni Brygoo and Domergue, 1970	Madagascar
Brookesia thieli Brygoo and Domergue, 1969	Madagascar
Brookesia tristis Glaw, Köhler, Townsend, and Vences, 2012	Madagascar
Brookesia tuberculata Mocquard, 1894	Madagascar
Brookesia vadoni Brygoo and Domergue, 1968	Madagascar
Brookesia valerieae Raxworthy, 1991	Madagascar
Calumma amber Raxworthy and Nussbaum, 2006	Madagascar
Calumma ambreense (Ramanantsoa, 1974)	Madagascar
Calumma andringitraense (Brygoo, Blanc, and Domergue, 1972)	Madagascar
Calumma boettgeri (Boulenger, 1888)	Madagascar
Calumma brevicorne (Günther, 1879)	Madagascar
Calumma capuroni (Brygoo, Blanc, and Domergue, 1972)	Madagascar
Calumma crypticum Raxworthy and Nussbaum, 2006	Madagascar
Calumma cucullatum (Gray, 1831)	Madagascar
Calumma fallax (Mocquard, 1900)	Madagascar
Calumma furcifer (Vaillant and Grandidier, 1880)	Madagascar
Calumma gallus (Günther, 1877)	Madagascar
Calumma gastrotaenia (Boulenger, 1888)	Madagascar
Calumma glawi Böhme, 1997	Madagascar
Calumma globifer (Günther, 1879)	Madagascar
Calumma guibei (Hillenius, 1959)	Madagascar
Calumma guillaumeti (Brygoo, Blanc, and Domergue, 1974)	Madagascar
Calumma hafahafa Raxworthy and Nussbaum, 2006	Madagascar
Calumma hilleniusi (Brygoo, Blanc, and Domergue, 1973)	Madagascar
Calumma jejy Raxworthy and Nussbaum, 2006	Madagascar
Calumma linota (Müller, 1924)	Madagascar
Calumma malthe (Günther, 1879)	Madagascar
Calumma marojezense (Brygoo, Blanc, and Domergue, 1970)	Madagascar
Calumma nasutum (Duméril and Bibron, 1836)	Madagascar
Calumma oshaughnessyi (Günther, 1881)	Madagascar
Calumma parsonii (Cuvier, 1824)	Madagascar
Calumma peltierorum Raxworthy and Nussbaum, 2006	Madagascar
Calumma peyrierasi (Brygoo, Blanc, and Domergue, 1974)	Madagascar

Species	Region
Calumma tarzan Gehring, Pabijan, Ratsoavina, Köhler, Vences, and Glaw, 2010	Madagascar
Calumma tsaratananense (Brygoo and Domergue, 1967)	Madagascar
Calumma tsycorne Raxworthy and Nussbaum, 2006	Madagascar
Calumma vatosoa Andreone, Mattioli, Jesu, and Randrianirina, 2001	Madagascar
Calumma vencesi Andreone, Mattioli, Jesu, and Randrianirina, 2001	Madagascar
Calumma vohibola Gehring, Ratsoavina, Vences, and Glaw, 2011	Madagascar
Chamaeleo africanus Laurenti, 1768	West-central Africa, North Africa
Chamaeleo anchietae Bocage, 1872	West-central Africa
Chamaeleo arabicus (Matschie, 1893)	Arabia
Chamaeleo calcaricarens Böhme, 1985	North Africa
Chamaeleo calyptratus Duméril & Duméril, 1851	Arabia
Chamaeleo chamaeleon (Linnaeus, 1758)	Europe, North Africa, Arabia
Chamaeleo dilepis Leach, 1819	Pan Africa
Chamaeleo gracilis Hallowell, 1842	East Africa, West-central Africa
Chamaeleo laevigatus (Gray, 1863)	East Africa
Chamaeleo monachus (Gray, 1865)	Socotra Island
Chamaeleo namaquensis Smith, 1831	Southern Africa
Chamaeleo necasi Ullenbruch, Krause, Böhme, 2007	West-central Africa
Chamaeleo senegalensis Daudin, 1802	West-central Africa
Chamaeleo zeylanicus Laurenti, 1768	Asia
Furcifer angeli (Brygoo and Domergue, 1968)	Madagascar
Furcifer antimena (Grandidier, 1872)	Madagascar
Furcifer balteatus (Duméril and Bibron, 1851)	Madagascar
Furcifer belalandaensis (Brygoo and Domergue, 1970)	Madagascar
Furcifer bifidus (Brongniart, 1800)	Madagascar
Furcifer campani (Grandidier, 1872)	Madagascar
Furcifer cephalolepis (Günther, 1880)	Comoros
Furcifer labordi (Grandidier, 1872)	Madagascar
Furcifer lateralis (Gray, 1831)	Madagascar
Furcifer major (Brygoo, 1971)	Madagascar
Furcifer minor (Günther, 1879)	Madagascar
Furcifer nicosiai Jesu, Mattioli, and Schimmenti, 1999	Madagascar
Furcifer oustaleti (Mocquard, 1894)	Madagascar
Furcifer pardalis (Cuvier, 1829)	Madagascar
Furcifer petteri (Brygoo and Domergue, 1966)	Madagascar
Furcifer polleni (Peters, 1874)	Comoros
Furcifer rhinoceratus (Boettger, 1893)	Madagascar
Furcifer timoni Glaw, Köhler, and Vences, 2009	Madagascar
Furcifer tuzetae (Brygoo, Bourgat, and Domergue, 1972)	Madagascar
Furcifer verrucosus (Cuvier, 1829)	Madagascar
Furcifer viridis Florio, Ingram, Rakotondravony, Louis, and Raxworthy, 2012	Madagascar

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Species	Region
Furcifer willsii (Günther, 1890)	Madagascar
Kinyongia adolfifriderici (Sternfeld, 1912)	East Africa
Kinyongia asheorum Necas, Sindaco, Korený, Kopecná, Malonza, and Modrý, 2009	East Africa
Kinyongia boehmei (Lutzmann and Necas, 2002)	East Africa
Kinyongia carpenteri (Parker, 1929)	East Africa
Kinyongia excubitor (Barbour, 1911)	East Africa
Kinyongia fischeri (Reichenow, 1887)	East Africa
Kinyongia gyrolepis Greenbaum, Tolley, Joma, and Kusamba, 2012	East Africa
Kinyongia magomberae Menegon, Tolley, Jones, Rovero, Marshall, and Tilbury, 2009	East Africa
Kinyongia matschiei (Werner, 1895)	East Africa
Kinyongia multituberculata (Nieden, 1913)	East Africa
Kinyongia oxyrhina (Klaver and Böhme, 1988)	East Africa
Kinyongia tavetana (Steindachner, 1891)	East Africa
Kinyongia tenuis (Matschie, 1892)	East Africa
Kinyongia uluguruensis (Loveridge, 1957)	East Africa
Kinyongia uthmoelleri (Müller, 1938)	East Africa
Kinyongia vanheygeni Necas, 2009	East Africa
Kinyongia vosseleri (Nieden, 1913)	East Africa
Kinyongia xenorhina (Boulenger, 1901)	East Africa
Nadzikambia baylissi Branch and Tolley, 2010	East Africa
Nadzikambia mlanjensis (Broadley, 1965)	East Africa
Rhampholeon acuminatus Mariaux and Tilbury, 2006	East Africa
Rhampholeon beraduccii Mariaux and Tilbury, 2006	East Africa
Rhampholeon boulengeri Steindachner, 1911	East Africa
Rhampholeon chapmanorum Tilbury, 1992	East Africa
Rhampholeon gorongosae Broadley, 1971	Southern Africa
Rhampholeon marshalli Boulenger, 1906	Southern Africa
Rhampholeon moyeri Menegon, Salvidio, and Tilbury, 2002	East Africa
Rhampholeon nchisiensis (Loveridge, 1953)	East Africa
Rhampholeon platyceps Günther, 1893	East Africa
Rhampholeon spectrum (Buchholz, 1874)	West-central Africa
Rhampholeon spinosus (Matschie, 1892)	East Africa
Rhampholeon temporalis (Matschie, 1892)	East Africa
Rhampholeon uluguruensis Tilbury and Emmrich, 1996	East Africa
Rhampholeon viridis Mariaux and Tilbury, 2006	East Africa
Rieppeleon brachyurus (Günther, 1893)	East Africa
Rieppeleon brevicaudatus (Matschie, 1892)	East Africa
Rieppeleon kerstenii (Peters, 1868)	East Africa, North Africa
Trioceros affinis (Rüppel, 1845)	North Africa
Trioceros balebicornutus (Tilbury, 1998)	North Africa
Trioceros bitaeniatus (Fischer, 1884)	East Africa
Trioceros camerunensis (Müller, 1909)	West-central Africa
Trioceros chapini (De Witte, 1964)	West-central Africa
Trioceros conirostratus (Tilbury, 1998)	East Africa

Species	Region
Trioceros cristatus (Stutchbury, 1837)	West-central Africa
Trioceros deremensis (Matschie, 1892)	East Africa
Trioceros ellioti (Günther, 1895)	East Africa
Trioceros feae (Boulenger, 1906)	West-central Africa
Trioceros fuelleborni (Tornier, 1900)	East Africa
Trioceros goetzei (Tornier, 1899)	East Africa
Trioceros hanangensis Krause & Böhme, 2010	East Africa
Trioceros harennae (Largen, 1995)	North Africa
Trioceros hoehnelii (Steindachner, 1891)	East Africa
Trioceros incornutus (Loveridge, 1932)	East Africa
Trioceros ituriensis (Schmidt, 1919)	East Africa, Central Africa
Trioceros jacksonii (Boulenger, 1896)	East Africa
Trioceros johnstoni (Boulenger, 1901)	East Africa, Central Africa
Trioceros kinangopensis Stipala, Lutzmann, Malonza, Wilkinson, Godley, Nyamache, and Evans, 2012	East Africa
Trioceros kinetensis (Schmidt, 1943)	East Africa
Trioceros laterispinis (Loveridge, 1932)	East Africa
Trioceros marsabitensis (Tilbury, 1991)	East Africa
Trioceros melleri (Gray, 1865)	East Africa
Trioceros montium (Buchholz, 1874)	West-central Africa
Trioceros narraioca (Necas, Modry, and Slapeta, 2003)	East Africa
Trioceros ntunte (Necas, Modry, and Slapeta, 2005)	East Africa
Trioceros nyirit Stipala, Lutzmann, Malonza, Wilkinson, Godley, Nyamache, and Evans, 2011	East Africa
Trioceros oweni (Gray, 1831)	West-central Africa
Trioceros perreti (Klaver and Böhme, 1992)	West-central Africa
Trioceros pfefferi (Tornier, 1900)	West-central Africa
Trioceros quadricornis (Tornier, 1899)	West-central Africa
Trioceros rudis (Boulenger, 1906)	East Africa
Trioceros schoutedeni (Laurent, 1952)	East Africa
Trioceros schubotzi (Sternfeld, 1912)	East Africa
Trioceros serratus (Mertens, 1922)	West-central Africa
Trioceros sternfeldi (Rand, 1963)	East Africa
Trioceros tempeli (Tornier, 1900)	East Africa
Trioceros werneri (tornier, 1899)	East Africa
Trioceros wiedersheimi (Nieden, 1910)	West-central Africa

SOURCE: Glaw and Vences, 2007; Tolley and Burger, 2007; Tilbury, 2010; Uetz, 2012.

ABBREVIATIONS

asl	above sea level
cf.	compare
cm	centimeters
e.g.	for example
i.e.	that is
km	kilometers
m	meters
mm	millimeters
Mya	million years ago
Myr	million years
Ri.	Rieppeleon
Rh.	Rhampholeon
sp.	species (singular)
spp.	species (plural)

REFERENCES

Abate, A. 1998. Reports from the field: Parson's chameleon. *Chameleon Information Network* 29:17–25.

Abate, A. 2001. The fate of wild-caught chameleons exported for the pet trade. *Chameleon Information Network* 41:15.

Abu-Ghalyun, Y. 1990. Histochemical and ultrastructural features of the biceps brachii of the African chameleon (*Chamaeleo senegalensis*). *Acta Zoologica* 71:189–192.

Abu-Ghalyun, Y., L. Greenwald, T.E. Hetherington, and A.S. Gaunt. 1988. The physiological basis of slow locomotion in chameleons. *Journal of Experimental Zoology* 245:225–231.

Adams, G.K., R.M. Andrews, and L.M. Noble. 2010. Eggs under pressure: components of water potential of chameleon eggs during incubation. *Physiological and Biochemical Zoology* 83:207–214.

Adams, W.E. 1953. The carotid arch in lizards with particular reference to the origin of the internal carotid artery. *Journal of Morphology* 92:115–155.

Adams, W.E. 1957. The carotid bifurcation in *Chamaeleo*. *Anatomical Record* 128:651–663.

Adler, R. F., G. Gu, J.-J. Wang, G. J. Huffman, S. Curtis, and D. Bolvin. 2008. Relationships between global precipitation and surface temperature on interannual and longer timescales (1979–2006). *Journal of Geophysical Research* 113:D22104.

Aerts, P., R. Van Damme, B. Vanhooydonck, A. Zaaf, and A. Herrel. 2000. Lizard locomotion: how morphology meets ecology. *Netherlands Journal of Zoology* 50:261–277.

Agnarsson, I., and M. Kuntner. 2012. The generation of a biodiversity hotspot: biogeography and phylogeography of the Western Indian Ocean Islands, pp. 33–82. In K. Anamthawat-Jonsson, Ed., *Current Topics in Phylogenetics and Phylogeography of Terrestrial and Aquatic Systems*. Rijeka, Croatia: InTech.

Akani, G.C., O.K. Ogbalu, and L. Luiselli. 2001. Life-history and ecological distribution of chameleons (Reptilia, Chamaeleonidae) from the rain forests of Nigeria: conservation implications. *Animal Biodiversity and Conservation* 24:1–15.

Ali, J.R., and M. Huber, 2010. Mammalian biodiversity on Madagascar controlled by ocean currents. *Nature* 463:653–680.

Ali, J.R., and D.W. Krause. 2011. Late Cretaceous bioconnections between Indo-Madagascar and Antarctica: refutation of the Gunnerus Ridge causeway hypothesis. *Journal of Biogeography* 38:1855–1872.

Ali, S.M. 1948. Studies on the anatomy of the tail in Sauria and Rhynchocephalia. II. *Chamaeleo zeylanicus* Laurenti. *Proceedings of the Indian Academy of Science* 28B:151–165.
Alifanov, V.R. 1989. New priscagamids (Lacertilia) from the Upper Cretaceous of Mongolia and their systematic position among Iguania. *Paleontological Journal* 23(4):68–80. (Translated from Russian: *Paleontologicheskii Zhurnal* 23(4):73–87.)
Alifanov, V.R. 1991. A revision of *Tinosaurus asiaticus* Gilmor [sic] (Agamidae). *Paleontological Journal* 25(3):148–154. (Translated from Russian: *Paleontologicheskii Zhurnal* 25(3):115–119.)
Alifanov, V.R. 1993. Some peculiarities of the Late Cretaceous and Palaeogene lizard faunas of the Mongolian People's Republic. *Kaupia* 3:9–13.
Alifanov, V.R. 1996. Lizards of the families Priscagamidae and Hoplocercidae (Sauria, Iguania): phylogenetic position and new representatives from the Late Cretaceous of Mongolia. *Paleontological Journal* 30(4):466–483. (Translated from Russian: *Paleontologicheskii Zhurnal* 30(4):100–118.)
Alifanov, V.R. 2000. The fossil record of Cretaceous lizards from Mongolia, pp. 368–389. In M.J. Benton, M.A. Shishkin, D.M. Unwin, and E.N. Kurochkin, Eds., *The Age of Dinosaurs in Russia and Mongolia*. Cambridge, United Kingdom: Cambridge University Press.
Alifanov, V.R. 2004. *Parauromastyx gilmorei* gen. et sp. nov. (Isodontosauridae, Iguania), a new lizard from the Upper Cretaceous of Mongolia. *Paleontological Journal* 38(2):206–210. (Translated from Russian: *Paleontologicheskii Zhurnal* 38(2):87–92.)
Alifanov, V.R. 2009. New acrodont lizards (Lacertilia) from the Middle Eocene of Southern Mongolia. *Paleontological Journal* 43(6):675–685. (Translated from Russian: *Paleontologicheskii Zhurnal* 43(6):68–77.)
Altevogt, R. 1977. *Chamaeleo jacksonii* (Chamaeleonidae)—Beutefang. *Publikationen zu Wissenschaftlichen Filmen. Sektion Biologie* 10(49):3–12 [in German with English summary].
Altevogt, R., and R. Altevogt. 1954. Studien zur Kinematik der Chamaleonenzunge. *Zeitschrift für vergleichende Physiologie* 36:66–77 [in German].
Anderson, C.V., and S.M. Deban. 2010. Ballistic tongue projection in chameleons maintains high performance at low temperature. *Proceedings of the National Academy of Sciences of the United States of America* 107:5495–5499.
Anderson, C.V., and S.M. Deban. 2012. Thermal effects on motor control and *in vitro* muscle dynamics of the ballistic tongue apparatus in chameleons. *Journal of Experimental Biology* 215:4345–4357.
Anderson, C.V., Sheridan, T. and S.M. Deban. 2012. Scaling of the ballistic tongue apparatus in chameleons. *Journal of Morphology* 273(11):1214–1226.
Andreone, F. 2004. Crossroads of herpetological diversity: Survey work for an integrated conservation of amphibians and reptiles in northern Madagascar. *Italian Journal of Zoology* 71:229–235.
Andreone, F., Andriamazava, A., Anjeriniaina, M., Glaw, F., Jenkins, R.K.B., Rabibisoa, N., Rakotomalala, D., Randrianantoandro, J.C., Randrianiriana, J., Randrianizahana , H., Raselimanana, A., Ratsoavina, F., Raxworthy, C.J., and Robsomanitrandrasana, E. 2011a. *Brookesia bonsi*. In: IUCN 2012, IUCN Red List of Threatened Species, Version 2012.1. Accessed at www.iucnredlist.org on July 31, 2012.
Andreone, F., Andriamazava, A., Anjeriniaina, M., Glaw, F., Jenkins, R.K.B., Rabibisoa, N., Rakotomalala, D., Randrianantoandro, J.C., Randrianiriana, J., Randrianizahana , H., Raselimanana, A., Ratsoavina, F., Raxworthy, C.J., and Robsomanitrandrasana, E. 2011b. *Calumma tarzan*. In: IUCN 2012, IUCN Red List of Threatened Species, Version 2012.1. Accessed at www.iucnredlist.org on July 31, 2012.

Andreone, F., Andriamazava, A., Anjeriniaina, M., Glaw, F., Jenkins, R.K.B., Rabibisoa, N., Rakotomalala, D., Randrianantoandro, J.C., Randrianiriana, J., Randrianizahana, H., Raselimanana, A., Ratsoavina, F., Raxworthy, C.J., and Robsomanitrandrasana, E. 2011c. *Calumma hafahafa*. In: IUCN 2012, IUCN Red List of Threatened Species, Version 2012.1. Accessed at www.iucnredlist.org on July 31, 2012.

Andreone, F., Andriamazava, A., Anjeriniaina, M., Glaw, F., Jenkins, R.K.B., Rabibisoa, N., Rakotomalala, D., Randrianantoandro, J.C., Randrianiriana, J., Randrianizahana, H., Raselimanana, A., Ratsoavina, F., Raxworthy, C.J., and Robsomanitrandrasana, E. 2011d. *Furcifer belalandaensis*. In: IUCN 2012, IUCN Red List of Threatened Species, Version 2012.1. Accessed at www.iucnredlist.org on July 31, 2012.

Andreone, F., Glaw, F., Mattioli, F., Jesu, R., Schimmenti, G., Randrianirina, J.E., and M. Vences. 2009. The peculiar herpetofauna of some Tsaratanana rainforests and its affinities with Manongarivo and other massifs and forests of northern Madagascar. *Italian Journal of Zoology* 76:92–110.

Andreone, F., F. Glaw, R. A. Nussbaum, C. J. Raxworthy, M. Vences, and J. E. Randrianirina. 2003. The amphibians and reptiles of Nosy Be (NW Madagascar) and nearby islands: a case study of diversity and conservation of an insular fauna. *Journal of Natural History* 37(17):2119–2149.

Andreone, F., F.M. Guarino, and J.E. Randrianirina. 2005. Life history traits, age profile, and conservation of the Panther Chameleon, *Furcifer pardalis* (Cuvier 1829), at Nosy Be, NW Madagascar. *Tropical Zoology* 18:209–225.

Andreone, F., F. Mattioli, R. Jesu, and J.E. Randrianirina. 2001. Two new chameleons of the genus *Calumma* from north-east Madagascar, with observations on hemipenial morphology in the *Calumma furcifer* group (Reptilia, Squamata). *Herpetological Journal* 11:53–68.

Andrews, R.M. 1971. Structural habitat and time budget of a tropical *Anolis* lizard. *Ecology* 52:262–270.

Andrews, R.M. 2005. Incubation temperature and sex ratio of the veiled chameleon (*Chamaeleo calyptratus*). *Journal of Herpetology* 39:515–518.

Andrews, R.M. 2007. Effects of temperature on embryonic development of the veiled chameleon, *Chamaeleo calyptratus*. *Comparative Biochemistry and Physiology A—Physiology* 148:698–706.

Andrews, R.M. 2008a. Effects of incubation temperature on growth and performance of the veiled chameleon (*Chamaeleo calyptratus*). *Journal of Experimental Zoology* 309A:435–446.

Andrews, R.M. 2008b. Lizards in the slow lane: Thermal biology of chameleons. *Journal of Thermal Biology* 33:57–61.

Andrews, R.M., C. Diaz-Paniagua, A. Marco, and A. Portheault. 2008. Developmental arrest during embryonic development of the common chameleon (*Chamaeleo chamaeleon*) in Spain. *Physiological and Biochemical Zoology* 81:336–344.

Andrews, R.M., and S. Donoghue. 2004. Effects of temperature and moisture on embryonic diapause of the veiled chameleon (*Chamaeleo calyptratus*). *Journal of Experimental Zoology* 301A:629–635.

Andrews, R.M., and K.B. Karsten. 2010. Evolutionary innovations of squamate reproductive and developmental biology in the family Chamaeleonidae. *Biological Journal of the Linnean Society* 100:656–668.

Andrews, R.M., and F.H. Pough. 1985. Metabolism of squamate reptiles: allometries and ecological relationships. *Physiological Zoology* 58:214–231.

Andriatsimietry, R., S.M. Goodman, E. Razafimahatratra, J.W.E. Jeglinski, M. Marquard, and J.U. Ganzhorn. 2009. Seasonal variation in the diet of *Galidictis grandidieri* Wozencraft, 1986 (Carnivora: Eupleridae) in a sub-arid zone of extreme south-western Madagascar. *Journal of Zoology* 279:410–415.

Angel, F. 1933. Sur un genre Malgasche nouveau, de la famille des Chamaeleontidés. *Bulletin du Musée D'Histoire Naturelle Paris* 5:443–446.

Angel, F. 1942. Les lézards de Madagascar. *Mémoires de l'Académie Malgache* 36:1–193

Aouraghe, H., J. Agustí, B. Ouchaou, S. Bailon, J.M. Lopez-Garcia, H. Haddoumi, K.E. Hammouti, A. Oujaa, and B. Bougariane. 2010. The Holocene vertebrate fauna from Guenfouda site, Eastern Morocco. *Historical Biology* 22(1–3):320–326.

Archer, M., D.A. Arena, M. Bassarova, R.M.D. Beck, K. Black, W.E. Boles, P. Brewer, B.N. Cooke, K. Crosby, A. Gillespie, H. Godthelp, S.J. Hand, B.P. Kear, J. Louys, A. Morrell, J. Muirhead, K.K. Roberts, J.D. Scanlon, K.J. Travouillon, and S. Wroe. 2006. Current status of species-level representation in faunas from selected fossil localities in the Riversleigh World Heritage Area, northwestern Queensland. *Alcheringa* Special Issue 1:1–17.

Aristotle (350 BC) Of the chameleon. Book 2, part 11. *Historia Animalium*. Oxford, United Kingdom: Clarendon Press.

Askew, G.N., and R.L. Marsh. 2001. The mechanical power output of the pectoralis muscle of blue-breasted quail (*Coturnix chinensis*): the *in vivo* length cycle and its implications for muscle performance. *Journal of Experimental Biology* 204(21):3587–3600.

Atsatt, R. 1953. Storage of sperm in the female chameleon *Microsaura pumila pumila*. *Copeia* 1953:59.

Augé, M. 1990. La faune de Lézards et d'Amphisbaenes de l'Éocène inférieur de Condé-en-Brie (France). *Bulletin du Muséum national d'Histoire naturelle, Paris*, 4e série, section C, 12:111–141 [in French].

Augé, M. 2005. Evolution des lézards du Paléogène en Europe. *Mémoires du Muséum National d'Histoire Naturelle* 192:1–369 [in French].

Augé, M., and J.C. Rage. 2006. Herpetofaunas from the Upper Paleocene and Lower Eocene of Morocco. *Annales de Paléontologie* 92:235–253.

Augé, M., and R. Smith. 1997. The Agamidae (Reptilia, Squamata) from the Paleogene of Western Europe. *Belgian Journal of Zoology* 127(2):123–138 [in French with English abstract].

Averianov, A., and I. Danilov. 1996. Agamid lizards (Reptilia, Sauria, Agamidae) from the Early Eocene of Kyrgyzstan. *Neues Jahrbuch für Geologie und Paläontologie-Monatshefte* 12:739–750.

Averianov, A.O. 2000. A new species of *Tinosaurus* from the Palaeocene of Kazakhstan (Squamata: Agamidae). *Zoosystematica Rossica* 9(2):459–460.

Averianov, A.O., A.V. Lopatin, P.P. Skutschas, N.V. Martynovich, S.V. Leshchinskiy, A.S. Rezvyi, S.A. Krasnolutskii, and A.V. Fayngertz. 2005. Discovery of Middle Jurassic mammals from Siberia. *Acta Palaeontologica Polonica* 50(4):789–797.

Axelrod, D.I., and P.H. Raven. 1978. Late Cretaceous and Tertiary vegetation history of Africa, pp. 77–130. In M.J.A. Werger, Ed., *Biogeography and Ecology of Southern Africa*. The Hague, The Netherlands: Junk.

Ayala-Guerrero, F., and G. Mexicano. 2008. Sleep and wakefulness in the green iguanid lizard (*Iguana iguana*). *Comparative Biochemistry and Physiology A—Physiology* 151:305–312.

Bagnara, J.T., and M.E. Hadley. 1973. *Chromatophores and Colour Change: The Comparative Physiology of Animal Pigmentation*. Englewood Cliffs, NJ: Prentice-Hall.

Balmford, A., Moore, J.L., Brooks, T., Burgess, N., Hansen, L.A., Williams, P., and C. Rahbek. 2001. Conservation conflicts across Africa. *Science* 291:2616–2619.

Bandyopadhyay, S., D.D. Gillette, S. Ray, and D.P. Sengupta. 2010. Osteology of *Barapasaurus tagorei* (Dinosauria: Sauropoda) from the Early Jurassic of India. *Palaeontology* 53:533–569.

Barej M.F., I. Ineich, V. Gvoždík, N. Lhermitte-Vallarino, N.L. Gonwouo, M. LeBreton, U. Bott, and A. Schmitz. 2010. Insights into chameleons of the genus *Trioceros* (Squamata: Chamaeleonidae) in Cameroon, with the resurrection of *Chamaeleon serratus* Mertens, 1922. *Bonn Zoological Bulletin* 57(2):211–229.

Barnett, K.E., R.B. Cocroft, and L.J. Fleishman. 1999. Possible communication by substrate vibration in a chameleon. *Copeia* 1999:225–228.

Bauer, A.M. 1997. Peritoneal pigmentation and generic allocation in the Chamaeleonidae. *African Journal of Herpetology* 46(2):117–122.

Beddard, F.E. 1904. Contribution to the anatomy of the Lacertilia. (3) On some points in the vascular system of *Chamaeleon* and other lizards. *Proceedings of the Zoological Society of London* 1904(2):6–22.

Beddard, F.E. 1907. Contributions to the knowledge of the systematic arrangement and anatomy of certain genera and species of Squamata. *Proceedings of the Zoological Society of London* 1907:35–45.

Bell, D.A. 1989. Functional anatomy of the chameleon tongue. *Zoologische Jahrbücher. Abteilung für Anatomie und Ontogenie der Tiere* 119:313–336.

Bell, D.A. 1990. Kinematics of prey capture in the chameleon. *Zoologische Jahrbücher. Abteilung für allgemeine Zoologie und Physiologie der Tiere* 94:247–260.

Bennett, A.F. 1985. Temperature and muscle. *Journal of Experimental Biology* 115:333–344.

Bennett, A.F. 2004. Thermoregulation in African chameleons, pp. 234–241. In S. Morris and A. Vosloo, Eds., *Animals and Environments: Proceedings of the Third International Conference of Comparative Physiology and Biochemistry, International Congress Series, Vol 1275*. Amsterdam, The Netherlands: Elsevier.

Bennett, A.F., and W.R. Dawson. 1976. Metabolism, pp. 127–223. In C. Gans and W.R. Dawson, Eds., *Biology of the Reptilia, Volume* 5. London: Academic Press.

Bennett, G. 1875. Notes on the *Chlamydosaurus* or frilled lizard of Queensland and the discovery of a fossil species. *Papers and Proceedings of the Royal Society of Tasmania* 1875:56–58.

Bennis, M., M. El Hassni, J-P. Rio, D. Lecren, J. Repérant, and R. Ward. 2001. A quantitative ultrastructural study of the optic nerve of the chameleon. *Brain Behavior and Evolution* 58:49–60.

Bennis, M., J. Repérant, J-P. Rio, and R. Ward. 1994. An experimental re-evaluation of the primary visual system of the European chameleon, *Chamelaeo chameleon*. *Brain Behavior and Evolution* 43:173–188.

Bennis, M., J. Repérant, R. Ward, and M. Wasowicz. 1996. Topography of the NADPH-Diaphorase system in the chameleon brain. *Journal of Brain Research* 2:281–288.

Bennis, M., C. Versaux-Botteri, J. Repérant, and J.A. Armengol. 2005. Calbindin, calretinin and parvalbumin immunoreactivity in the retina of the chameleon (*Chamaeleo chameleon*). *Brain Behavior and Evolution* 65:177–187.

Berger, P.J., and G. Burnstock. 1979. Autonomic nervous system, pp. 1–57. In R.G. Northcutt and P. Ulinski, Eds., *Biology of the Reptilia: Neurology*. London: Academic Press.

Bergeson, D. J. 1998. Patterns of suspensory feeding in *Alouatta palliata*, *Ateles geoffroyi*, and *Cebus capucinus*, pp. 45–60. In E. Strasser, J. Fleagle, A. Rosenberger and H. McHenry, Eds., *Primate Locomotion: Recent Advances*. New York: Plenum Press.

Bergmann, P.J., and D.J. Irschick. 2011. Vertebral evolution and the diversification of Squamate reptiles. *Evolution* 66(4):1044–1058.

Bergmann, P.J., S. Lessard, and A.P. Russell. 2003. Tail growth in *Chamaeleo dilepis* (Sauria: Chamaeleonidae): functional implications of segmental patterns. *Journal of Zoology, London* 261:417–425.

Bergquist, H. 1952. Studies on the cerebral tube in vertebrates: the neuromeres. *Acta Zoologica Stockholm* 33:117–187.

Bickel, R., and J.B. Losos. 2002. Patterns of morphological variation and correlates of habitat use in chameleons. *Biological Journal of the Linnean Society* 76(1):91–103.

Birkhead, T.R., and A.P. Møller. 1993. Sexual selection and the temporal separation of reproductive events: sperm storage data from reptiles, birds and mammals. *Biological Journal of the Linnean Society* 50:295–311.

Blackburn, D.G. 1999. Are viviparity and egg-guarding evolutionarily labile in squamates? *Herpetologica* 55:556–573.

Blackburn, D.G. 2006. Squamate reptiles as model organisms for the evolution of viviparity. *Herpetological Monographs* 20:131–146.

Blanc, C.P. 1972. Les reptiles de Madagascar et des îles voisines, pp. 501–614. In R. Battistini, and G. Vindard, Eds., *Biogeography and ecology in Madagascar*.The Hague, The Netherlands: Junk [in French].

Blanco, M.A., and P.W. Sherman. 2005. Maximum longevities of chemically protected and non-protected fishes, reptiles, and amphibians support evolutionary hypotheses of aging. *Mechanisms of Ageing and Development* 126:794–803.

Blasco, M. 1997a. *Chamaeleo chamaeleon*, pp. 158–159. In J.-P., Gasc, A. Cabela, J. Crnobrnja Isailovic, D. Dolmen, K. Grossenbacher, P. Haffner, J. Lescure, H. Martens, J.P. Martínez-Rica, H. Maurin, M.E. Oliveira, T.S. Sofianidou, M. Veith, and A. Zuiderwijk, Eds., *Atlas of Amphibians and Reptiles in Europe*. Paris, France: Societas Europaea Herpetologica and Muséum National d'Histoire Naturelle.

Blasco, M. 1997b. *Chamaelo chamaeleon* (Linnaeus, 1758) Camaleón común, Camaleão, pp. 190–192. In J.M. Pleguezuelos, Ed., *Distribución y Biogeografía de los anfibios y reptiles en España y Portugal*. Granada, Spain: Editorial Universidad de Granada [in Spanish].

Blob, R.W., and A.A. Biewener. 1999. *In vivo* locomotor strain in the hindlimb bones of *Alligator mississippiensis* and *Iguana iguana*: implications for the evolution of limb bone safety factor and non-sprawling limb posture. *Journal of Experimental Biology* 202:1023–1046.

Bockman, D.E. 1970. The thymus, pp 111–133. In C. Gans and T.S. Parsons, Eds., *Biology of the Reptilia. Volume 3. Morphology C*. New York: Academic Press.

Böhm, M., Collen, B., Baillie, J.E.M., Chanson, J., Cox, N., Hammerson, G., Hoffmann, M., Livingstone, S.R., Ram, M., Rhodin, A.G.J., Stuart, S.N. et al. 2013. The conservation status of the world's reptiles. *Biological Conservation* 157:372–385.

Böhme, M. 2003. The Miocene Climatic Optimum: evidence from ectothermic vertebrates of Central Europe. *Palaeogeography, Palaeoclimatology, Palaeoecology* 195:389–401.

Böhme, M. 2010. Ectothermic vertebrates (Actinopterygii, Allocaudata, Urodela, Anura, Crocodylia, Squamata) from the Miocene of Sandelzhausen (Germany, Bavaria) and their implications for environment reconstruction and palaeoclimate. *Paläontologische Zeitschrift* 84:3–41.

Böhme, W., and C.J.J. Klaver. 1980. The systematic status of *Chamaeleo kinetensis* Schmidt, 1943, from the Imatong mountains, Sudan, with comments on lung and hemipenal morphology within the *Chamaeleo bitaeniatus* group. *Amphibia-Reptilia* 1:3–17.

Boistel, R., A. Herrel, G. Daghfous, P.A. Libourel, E. Boller, P. Taffoureau, and V. Bels. 2010. Assisted walking in Malagasy dwarf chameleons. *Biology Letters* 6(6):740–743.

Bolliger, T. 1992. Kleinsäugerstratigraphie der miozänen Hörnilschüttung (Ostschweiz). *Dokumenta naturae* 75:1–297 [in German].

Bonetti, A. 1998. New life from Roman relics. *BBC Wildlife* 1998 16(7):10–16.

Bonine, K.E., and T. Garland Jr. 1999. Sprint performance of phrynosomatid lizards, measured on a high-speed treadmill, correlates with hindlimb length. *Journal of Zoology, London* 248:255–265.

Bons, J., and N. Bons. 1960. Notes sur la reproduction et le développement de *Chamaeleo chamaeleon* (L.). *Bulletin de la Société des Sciences Naturelles et Physiques du Maroc* 40:323–335.

Born, G. 1879. Die Nasenhöhlen und der Thränennassengang der amnioten Wirbelthiere. *Morphologisches Jahrbuch* 5:62–140 [in German].

Borsuk-Białynicka, M. 1991. Questions and controversies about saurian phylogeny, a Mongolian perspective, pp. 9–10. In Z. Kielan-Jaworowska, N. Heintz, and H.A. Nacerem, Eds., *5th Symposium on Mesozoic Terrestrial Ecosystems and Biota (Extended Abstracts)*. Contributions of the Palaeontological Museum, University of Oslo 364.

Borsuk-Białynicka, M., and S.M. Moody. 1984. Priscagaminae, a new subfamily of the Agamidae (Sauria) from the Late Cretaceous of the Gobi Desert. *Acta Palaeontologica Polonica* 29(1–2):51–81.

Bosworth, W., P. Huchon, and K. McClay. 2005. The Red Sea and Gulf of Aden Basins. *Journal of African Earth Sciences* 43:334–378.

Bourgat, R. 1968. Etude des variations annuelles de la population de *Chamaeleo pardalis* Cuvier de l'Ile de la Reunion. *Vie Milieu* 19:227–231.

Bourgat, R.M. 1973. Cytogénétique des caméléons de Madagascar. Incidences taxonomiques, biogéographiques et phylogénétiques. *Bulletin de la Société Zoologique de France* 98(1):81–90.

Bourgat, R.M., and C.A. Domergue. 1971. Notes sur le *Chamaeleo tigris* Kuhl 1820 des Seychelles. *Annales de l'Université de Madagascar, Série Sciences de la Nature et Methématiques* 8:235–244.

Bowmaker, J.K., E.R. Loew, and M. Ott. 2005. The cone photoreceptors and visual pigments of chameleons. *Journal of Comparative Physiology A* 191:925–932.

Brady, L.D., and R.A. Griffiths. 1999. Status assessment of chameleons in Madagascar. Gland, Switzerland, and Cambridge, United Kingdom: IUCN Species Survival Commission.

Brady, L.D., and R.A. Griffiths. 2003. Chameleon population density estimates, pp. 970–972. In S. Goodman and J. Benstead, Eds., *The Natural History of Madagascar*. Chicago: University of Chicago Press.

Brady, L. D., K. Huston, R.K.B. Jenkins, J.L.D. Kauffmann, J. Rabearivony, G. Raveloson, and M. Rowcliffe. 1996. UEA Madagascar Expedition'93. Final Report. Unpublished Report, University of East Anglia: Norwich.

Brain, C.K. 1961. *Chamaeleo dilepis*—a study on its biology and behavior. *Journal of the Herpetological Association of Rhodesia* 15:15–20.

Bramble, D.M., and D.B. Wake. 1985. Feeding mechanisms of lower tetrapods, pp 230–261. In M. Hildebrand, D.M. Bramble, K.F. Liem, and D.B. Wake, Eds., *Functional Vertebrate Morphology*. Cambridge, United Kingdom: Cambridge University Press.

Branch, W.R. 1998. *Field Guide to the Snakes and Other Reptiles of Southern Africa*. Cape Town, South Africa: Struik.

Branch, W.R., and J. Bayliss. 2009. A new species of *Atheris* (Serpentes: Viperidae) from northern Mozambique. *Zootaxa* 2113:41–54.

Branch, W.R., and K.A. Tolley. 2010. A new species of chameleon (Sauria: Chamaeleonidae: *Nadzikambia*) from Mount Mabu, central Mozambique. *African Journal of Herpetology* 59:157–172.

Briggs, JC. 2003. The biogeographic and tectonic history of India. *Journal of Biogeography* 30:381–388.

Bringsøe, H. 2007. An observation of *Calumma tigris* (Squamata: Chamaeleonidae) feeding on White-footed ants, *Technomyrmex albipes* complex, in the Seychelles. *Herpetological Bulletin* 102:15–17.

Brink, J.M. 1957. Vergelijkend karyologisch onderzoek aan het genus *Chamaeleon*. *Genen en phaenen* 2:35–40.

Broadley, D.G. 1965. A new chameleon from Malawi. *Arnoldia* 31:1–3.

Broadley, D.G. 1966. Studies on the ecology and ethology of African lizards. *Journal of the Herpetological Association of Africa* 2:6–16.

Broadley, D.G. 1973. Predation on birds by reptiles and amphibians in south-eastern Africa. *Honeyguide* 76:19–21
Broadley, D.G. 1983. *FitzSimons' Snakes of Southern Africa* (rev. ed.). Johannesburg, South Africa: Delta Books.
Broadley, D.G., and D.K. Blake. 1979. A field study of *Rhampholeon marshalli marshalli* on Vumba Mountain, Rhodesia (Sauria: Chamaeleonidae). *Arnoldia* 8:1–6.
Brock, G.T. 1941. The skull of the chameleon, *Lophosaura ventralis* (Gray); some developmental stages. *Proceedings of the Zoological Society of London B* 110(3–4):219–241.
Brooks, T.M., R.A. Mittermeier, C.G. Mittermeier, G.A.B. da Fonseca, A.B. Rylands, W.R. Konstant, P. Flick, J. Pilgrim, S. Oldfield, G. Magin, and C. Hilton-Taylor. 2002. Habitat loss and extinction in the hotspots of biodiversity. *Conservation Biology* 16:909–923.
Broschinski, A. 2000. The lizards from the Guimarota mine, pp. 59–68 in T. Martin, and B. Krebs, Eds., *Guimarota: A Jurassic Ecosystem*. Munich: Verlag Dr. Friedrich Pfeil.
Brücke, E. 1852a. Über die Zunge der Chamäleonen. *Sitzungsberichte der Mathematisch-Naturwissenschaftlichen Classe der Kaiserlichen Akademie der Wissenschaften* 8:65–70 [in German].
Brücke, E. 1852b. Untersuchungen be idem Farbwechsel des afrikanischen Chameleons. *Denkschrift der Kaiserlichen Akademie der Wissenschaften in Wien* 4:179–210.
Bruner, H.L. 1907. On the cephalic veins and sinuses of reptiles, with description of a mechanism for raising the venous blood-pressure in the head. *American Journal of Anatomy* 7:1–117.
Brygoo, E.R. 1971. Reptiles Sauriens Chamaeleonidae. Genre *Chamaeleo*. *Faune de Madagascar* 33:1–318.
Brygoo, E.R. 1978. Reptiles Sauriens Chamaeleonidae. Genre *Brookesia* et complement pour le genre *Chamaeleo*. *Faune de Madagascar* 47:1–173.
Burgess, N.D., Balmford, A., Cordeiro, N.J., Fjeldså, J., Küper, W., Rahbek, C., Sanderson, E.W., Scharlemann, J.R.P.W., Sommer, J.H., and P.H. Williams. 2007. Correlations among species distributions, human density and human infrastructure across the high biodiversity tropical mountains of Africa. *Biological Conservation* 134:164–177.
Burmeister, E.-G., 1989. Eine Walzenspinne (Solifugae, Galeodidae) als Nahrung des Gemeinen Chamäleons (*Chamaeleo chamaeleon* Linnaeus, 1758). *Herpetofauna* 11:32–34.
Burrage, B.R. 1973. Comparative ecology and behaviour of *Chamaeleo pumilis pumilis* (Gmelin) and *C. namaquensis* A. Smith (Sauria: Chamaeleonidae). *Annals of the South African Museum* 61:1–158.
Bustard, H.R. 1966. Observations on the life history and behavior of *Chamaeleo bitaeniatus* Fischer. *Herpetologica* 22:13–23.
Bustard, H.R. 1967. The comparative behavior of chameleons: fight behavior in *Chamaeleo gracilis* Hallowell. *Herpetologica* 23:44–50.
Butchart, S.H.M., Walpole, M., Collen, B., Van Strien, A., Scharlemann, J.R.P.W., Almond, R.E.A., Baillie, J.E.M., Bomhard, B., Brown, C., Bruno, J., Carpenter, K.E., Carr, G.V.M., Chanson, J., Chenery, A.M., Csirke, J., Davidson, N.C., Dentener, F., Foster, M., Galli, A., Galloway, J.N., Genovesi, P., Gregory, R.D., Hockings, M., Kapos, V., Lamarque, J.-F., Leverington, F., Loh, J., McGeoch, M.A., McRae, L., Minasyan, A., Morcillo, M.H.N., Oldfield, T.E.E., Pauly, D., Quader, S., Revenga, C., Sauer, J.R., Skolnik, B., Spear, D., Stanwell-Smith, D., Stuart, S.N., Symes, A., Tierney, M., Tyrrell, T.D., Vié, J.-C., and R. Watson. 2010. Global biodiversity: indicators of recent declines. *Science* 328:1164–1168.

Butler, M.A. 2005. Foraging mode of the chameleon, *Bradypodion pumilum*: a challenge to the sit-and-wait versus active forager paradigm? *Biological Journal of the Linnean Society* 84:797–808.
Camargo, C.R., M.A. Visconti, and A.M.L. Castrucci. 1999. Physiological color change in the bullfrog, *Rana catesbeiana*. *Journal of Experimental Zoology* 283:160–169.
Camp, C.L. 1923. Classification of the lizards. *Bulletin of the American Museum of Natural History* 48:289–481.
Canella, M.F. 1963. Note di fisiologia dei cromatofori dei vertebrati pecilotermi, particolarmente dei lacertili. *Monitore Zoologico Italiano* 71:430–480.
Canham, M.T. 1999. The identification of specialized scale surface structures and scale arrangements of the ventral portion of a prehensile tail, used for increased rip in the *Chamaeleo* genus. *Chameleon information Network* 33:5–8.
Carothers, J. H. 1986. An experimental confirmation of morphological adaptation: toe fringes in the sand-dwelling lizard *Uma scoparia*. *Evolution* 40(4):871–874.
Carpenter, A.I., and O. Robson. 2005. A review of the endemic chameleon genus *Brookesia* from Madagascar, and the rationale for its listing on CITES Appendix II. *Oryx* 39:375–380.
Carpenter, A.I., Robson, O., Rowcliffe, J.M., and A.R. Watkinson. 2005. The impacts of international and national governance changes on a traded resource: a case study of Madagascar and its chameleon trade. *Biological Conservation* 123:279–287.
Carpenter, A.I., Rowcliffe, J.M., and A.R. Watkinson. 2004. The dynamics of the global trade in chameleons. *Biological Conservation* 120:291–301.
Carpenter, G.C. 1977. Variation and evolution of stereotyped behavior in reptiles, pp. 335–403. In C. Gans and D.W. Tinkle, Eds., *Biology of Reptiles*. London: Academic Press.
Cartmill, M. 1985. Climbing, pp. 73–88. In M. Hildebrand, D. M. Bramble, K. F. Liem and D. B. Wake, Eds., *Functional Vertebrate Morphology*. Cambridge, United Kingdom: Belknap Press.
Case, E.C. 1909. The dorsal spines of *Chameleo cristatus*, Stuch. *Science (Weekly)* 29(755):979.
Čerňanský, A. 2010. A revision of chamaeleonids from the Lower Miocene of the Czech Republic with description of a new species of *Chamaeleo* (Squamata, Chamaeleonidae). *Geobios* 43:605–613.
Čerňanský, A. 2011. A revision of the chameleon species *Chamaeleo pfeili* Schleich (Squamata; Chamaeleonidae) with description of a new material of chamaeleonids from the Miocene deposits of southern Germany. *Bulletin of Geosciences* 86(2):275–282.
Cheke, A.S. 1987. An ecological history of the Mascarene Islands, with particular reference to extinctions and introductions of land vertebrates, pp. 5–89. In A.W. Diamond, Ed., *Studies of Mascarene Island Birds*. Cambridge, United Kingdom: Cambridge University Press.
Cheke, A.S., and J. Hume. 2008. *Lost Land of the Dodo*. London: Poyser.
Chevret, P., and G. Dobigny. 2005. Systematics and evolution of the subfamily Gerbillinae (Mammalia, Rodentia, Muridae). *Molecular Phylogenetics and Evolution* 35:674–688.
Chkhikvadze, V.M. 1985. Preliminary results of the study of Tertiary amphibians and squamate reptiles of the Zaisan Basin. *Voprosy Gerpetologii – Shestaya Vsesoyuznaya* 7 *Gerpetologicheskaya Konferentsiya, Tashkent, 18–20 sentyabrya 1985, Avtoreferaty dokladov*, 234–235 [in Russian].
Chorowicz, J. 2005. The East African rift system. *Journal of African Earth Sciences* 43:379–410.
Cincotta, R., Wisnewski, J., and R. Engelman. 2000. Human population in the biodiversity hotspots. *Nature* 404:990–992.
CITES. 2012a. CITES trade statistics derived from the CITES Trade Database, Cambridge, United Kingdom: UNEP World Conservation Monitoring Centre. Accessed June 13, 2012.

CITES. 2012b. Notification to the Parties No. 2012/021. Accessed April 11, 2012.
Clothier, J., and J.N. Lythgoe. 1987. Light-induced color changes by the iridophores of the neon tetra, *Paracheirodon innesi*. *Journal of Cell Science* 88:663–668.
Clusella-Trullas, S., Blackburn, T.M., and S.L. Chown. 2011. Climatic predictors of temperature performance curve parameters in ectotherms imply complex responses to climate change. *The American Naturalist* 177:738–751.
Cole, N. 2009. *A Field Guide to the Reptiles and Amphibians of Mauritius*. Vacoas, Mauritius: Mauritian Wildlife Foundation.
Conrad, J.L. 2008. Phylogeny and systematics of Squamata (Reptilia) based on morphology. *Bulletin of the American Museum of Natural History* 310:1–182.
Conrad, J.L., and M.A. Norell. 2007. A complete Late Cretaceous iguanian (Squamata, Reptilia) from the Gobi and identification of a new Iguanian Clade. *American Museum Novitates* 3587:1–47.
Cooper, W.E., and L.J. Vitt. 2002. Distribution, extent, and evolution of plant consumption by lizards. *Journal of Zoology* 257:487–517.
Cooper, W.E., and N. Greenberg. 1992. Reptilian coloration and behavior, pp. 298–422. In C. Gans and D. Crews, Eds., *Biology of the Reptilia*. Chicago: Chicago University Press.
Cope, E.D. 1892. The osteology of the Lacertilia. *Proceedings of the American Philosophical Society* 30:185–219.
Couvreur, T.L.P., Chatrou, L.W., Sosef, M.S.M., and J.E. Richardson. 2008. Molecular phylogenetics reveal multiple tertiary vicariance origins of the African rain forest trees. *BMC Biology* 6:54.
Couvreur, T.L.P., Forest, F., and W.J. Baker. 2011. Origin and global diversification patterns of tropical rain forests: inferences from a complete genus-level phylogeny of palms. *BMC Biology* 9:44.
Covacevich, J., P. Couper, R.E. Molnar, G. Witten, and W. Young, 1990. Miocene dragons from Riversleigh: new data on the history of the family Agamidae (Reptilia: Squamata) in Australia. *Memoirs of the Queensland Museum* 29:339–360.
Crespo, E. G., and M.E. Oliveira. 1989. Atlas da Distribucao dos Anfibios e Répteis de Portugal Continental. Servicio Nacional de Parques Reservas e Conservacao da Naturaleza, Lisboa [in Portuguese].
Crottini, A., D.J. Harris, I.A. Irisarri, A. Lima, S. Rasamison, and G.M. Rosa. 2010. Confirming Domergue: *Ithycyphus oursi* Domergue, 1986 predation upon *Furcifer oustaleti* (Mocquard, 1894). *Herpetology Notes* 3:127–131.
Cuadrado, M. 1998a. The influence of female size on the extent and intensity of mate guarding by males in *Chamaeleo chamaeleon*. *Journal of Zoology* 246:351–358.
Cuadrado, M. 1998b. The use of yellow spot colors as a sexual receptivity signal in females of *Chamaeleo chamaeleon*. *Herpetologica* 54:395–402.
Cuadrado, M. 2000. Body colors indicate the reproductive status of female Common chameleons: experimental evidence for the inter-sex communication function. *Ethology* 106:79–91.
Cuadrado, M. 2001. Mate guarding and social mating system in male common chameleons (*Chamaeleo chamaeleon*). *Journal of Zoology* 255:425–435.
Cuadrado, M., and J. Loman. 1997. Mating behaviour in a chameleon (*Chamaeleo chamaeleon*) population in southern Spain—effects of male and female size, pp. 81–88 in W. Böhme, W. Bischoff and T. Ziegler, Eds., *Herpetologica Bonnensis*. Bonn, Germany: Societas Europaea Herpetologica: Bonn.
Cuadrado, M., and Loman, J. 1999. The effects of age and size on reproductive timing in female *Chamaeleo chamaeleon*. *Journal of Herpetology* 33:6–11.
Cuadrado, M., J. Martin, and P. Lopez. 2001. Camouflage and escape decisions in the common chameleon, *Chamaeleo chamaeleon*. *Biological Journal of the Linnean Society* 72:547–554.

Cuvier, G. 1805. Lecons d'Anatomie Comparée, Tome III. Paris: Recueillies et Publiés par L. Duvernoy [in French].

Daniels, S.R., and J. Bayliss. 2012. Neglected refugia of biodiversity: mountainous regions in Mozambique and Malawi yield two novel freshwater crab species (Potamonautidae: Potamonautes). *Zoological Journal of the Linnean Society* 164:498–509.

Dart, R.A. 1934. The dual structure of the neopallium: its history and significance. *Journal of Anatomy* 69:3–19.

daSilva, J.M., and K.A. Tolley. 2013. Ecomorphological variation and sexual dimorphism in a recent radiation of dwarf chameleons (*Bradypodion*). *Biological Journal of the Linnean Society* 109(1): 113–130.

Datta, P.M., and S. Ray. 2006. Earliest lizard from the Late Triassic (Carnian) of India. *Journal of Vertebrate Paleontology* 26(4):795–800.

Davenport, T.R.B., W.T. Stanley, E.J. Sargis, D.W. De Luca, N.E. Mpunga, S.J. Machaga, and L.E. Olson. 2006. A new genus of African monkey, *Rungwecebus:* morphology, ecology, and molecular phylogenetics. Science 312:1378–1381.

D'Cruze, N.C., and J.A. Sabel. 2005. *Ptychadena mascareniensis* (Mascarene ridged frog): predation on an endemic malagasy chameleon. *Herpetological Bulletin* 93:26–27.

de Groot, J.H., and J.L. van Leeuwen. 2004. Evidence for an elastic projection mechanism in the chameleon tongue. *Proceedings of the Royal Society B* 271(1540):761–770.

De Quieroz, K. 1995. Phylogenetic approaches to classification and nomenclature, and the history of taxonomy (an alternative interpretation). *Herpetological Review* 26(2):79–81.

de Stefano, G. 1903. I sauri del Quercy appartenentialla collenzione Rossignol. *Atti della Societa Italiana di Scienze Naturalie del Museo Civico di Storia Naturale di Milano* 42:382–418 [in Italian].

Delfino, M., T. Kotsakis, M. Arca, C. Tuveri, G. Pitruzzella, and L. Rook. 2008. Agamid lizards from the Plio-Pleistocene of Sardinia (Italy) and an overview of the European fossil record of the family. *Geodiversitas* 30(3):641–656.

Dewevre, L.S. 1895. Le méchanime de la projection de la langue chez le caméléon. *Journal de l'anatomie et de la physiologie normales et pathologiques de l'homme et des animaux* 31:343–360 [in French].

Diaz-Paniagua, C. 2007. Effect of cold temperature on the length of incubation of *Chamaeleo chamaeleon*. *Amphibia-Reptilia* 28:387–392.

Diaz-Paniagua, C., and M. Cuadrado. 2003. Influence of incubation conditions on hatching success, embryo development and hatchling phenotype of common chameleon (*Chamaeleo chamaeleon*) eggs. *Amphibia-Reptilia* 24:429–440.

Díaz-Paniagua, C., M. Cuadrado, M.C. Blázquez, and J.A. Mateo. 2002. Reproduction of *Chamaeleo chamaeleon* under contrasting environmental conditions. *Herpetological Journal* 12:99–104.

Dierenfeld, E.S., E.B. Norkus, K. Caroll, and G.W. Ferguson. 2002. Carotenoids, vitamin A and vitamin E concentrations during egg development in panther chameleons (*Furcifer pardalis*). *Zoo Biology* 21:295–303.

Dimaki, M., A.K. Hundsdörfer, and U. Fritz. 2008. Eastern Mediterranean chameleons (*Chamaeleo chamaeleon, Ch. africanus*) are distinct. *Amphibia-Reptilia* 29:535–540.

Dimaki, M., E.D. Valakos, and A. Legakis. 2000. Variation in body temperatures of the African Chameleon *Chamaeleo africanus* Laurenti, 1768 and the Common Chameleon *Chamaeleo chamaeleon* (Linnaeus, 1758). *Belgian Journal of Zoology* 130:87–91.

Dong, Z.M. 1965. A new species of *Tinosaurus* from Lushih, Honan. *Vertebrata PalAsiatica* 9(1):79–83 [in Chinese with English summary].

Døving, K.B., and D. Trotier. 1998. Structure and function of the vomeronasal organ. *Journal of Experimental Biology* 201(21):2913–2925.

Drake, R.E., J.A. Van Couvering, M.H. Pickford, G.H. Curtis, and J.A. Harris. 1988. New chronology for the Early Miocene mammalian faunas of Kisingiri, Western Kenya. *Journal of the Geological Society, London* 145:479–491.

Duke-Elder, S. 1957. System of ophthalmology. Vol. I. The eye in evolution. London: Kimpton.

Dunson, W.A. 1976. Salt glands in reptiles, pp. 413–445. In C. Gans and W.R. Dawson, Eds., *Biology of the Reptilia. Volume 5. Physiology A*. New York: Academic Press.

Duvernoy, L.G. 1836. Sur les mouvements de la langue du chameleon. *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences, Paris* 2:349–351 [in French].

Edinger, T. 1955. The size of parietal foramen and organ in reptiles. A rectification. *Bulletin of the Museum of Comparative Zoology at Harvard College* 114:1–34.

Edgar, J.I. 1979. Fatbody and liver cycles in two tropical lizards *Chamaeleo hohneli* and *Chamaeleo jacksoni* (Reptilia, Lacertilia, Chamaeleonidae). *Journal of Herpetology* 13(1):113–117.

El Hassni, M., S. Ba M'Hamed, J. Repérant, and M. Bennis. 1997. Quantitative and topographical study of retinal ganglion cells in the chameleon (*Chamaeleo chameleon*). *Brain Research Bulletin* 44:621–625.

Emmett, D.A. 2004. Altitudinal distribution of the Short-Tailed Pygmy Chameleon (*Rhampholeon brevicaudatus*) and the Usambara Pitted Pygmy Chameleon (*R. temporalis*) in Tanzania. *African Herp News* 37:12–13.

Engelbrecht, D. van Z. 1951. Contributions to the cranial morphology of the chamaeleon *Microsaura pumila* Daudin. *Annale van die Uniwersiteit van Stellenbosch*. 27(1):3–31.

Estes, R. 1983a. *Sauria Terrestria, Amphisbaenia (Handbuch der Paläoherpetologie)*. Stuttgart, Germany: Gustav Fischer Verlag.

Estes, R. 1983b. The fossil record and the early distribution of lizards, pp. 365–398. In A.G.J. Rhodin, and K. Miyata, Eds., *Advances in Herpetology and Evolutionary Biology : Essays in Honor of E. E. Williams*. Cambridge, MA: Museum of Comparative Zoology, Harvard University.

Estes, R., K. de Queiroz, and J. Gauthier. 1988. Phylogenetic relationships within Squamata, pp. 119–281. In R. Estes, and G. Pregill, Eds., *Phylogenetic Relationships of the Lizard Families*. Stanford, CA: Stanford University Press.

Etheridge, R. 1967. Lizard caudal vertebrae. *Copeia* 1967(4):699–721.

Evans, S.E. 1998. Crown group lizards from the Middle Jurassic of Britain. *Palaeontographica, Abt. A* 250:123–154.

Evans, S.E. 2003. At the feet of the dinosaurs: the origin, evolution and early diversification of squamate reptiles (Lepidosauria: Diapsida). *Biological Reviews* 78:513–551.

Evans, S.E., and M.E.H. Jones. 2010. The origin, early history and diversification of lepidosauromorph reptiles, pp. 27–44. In S. Bandyopadhyay, Ed., *New Aspects of Mesozoic Biodiversity*. Lecture Notes in Earth Sciences 132. Berlin: Springer Verlag.

Evans, S.E., G.V.R. Prasad, and B.K. Manhas. 2001. Rhynchocephalians (Diapsida: Lepidosauria) from the Jurassic Kota Formation of India. *Zoological Journal of the Linnean Society* 133:309–334.

Evans, S.E., G.V.R. Prasad, and B.K. Manhas. 2002. An acrodont iguanian from the Mesozoic Kota Formation of India. *Journal of Vertebrate Paleontology* 22:299–312.

Farrell, A.P., A.K. Gamperl, and E.T. Francis. 1998. Comparative Aspects of Heart Morphology, pp. 375–424. In C. Gans and A.S. Gaunt, Eds., *Biology of the Reptilia. Volume 19. Morphology G*. Ithaca, NY: Society for the Study of Amphibians and Reptiles.

Fejfar, O., and H.H. Schleich. 1994. Ein Chamäleonfund aus dem unteren Orleanium des Braunkohlen-Tagebaus Merkur-Nord (Nordböhmen). *Courier Forschungsinstitut Senckenberg* 173:167–173 [in German].

Ferguson, G.W., W.H. Gehrmann, T.C. Chen, E.S. Dierenfeld, and M.F. Holick. 2002. Effects of artificial ultraviolet light exposure on reproductive success of the female panther chameleon (*Furcifer pardalis*) in captivity. *Zoo Biology* 21:525–537.

Ferguson, G.W., W.H. Gehrmann, K.B. Karsten, S.H. Hammack, Michele McRae, T.C. Chen, N.P. Lung, and M.F. Holick. 2003. Do panther chameleons bask to regulate endogenous vitamin D3 production. *Physiological and Biochemical Zoology* 76:52–59.

Ferguson, G.W., W.H. Gehrmann, K.B. Karsten, A.J. Landwer, E.N. Carman, T.C. Chen, and M.F. Holick. 2005. Ultraviolet exposure and vitamin D synthesis in a sun-dwelling and shade-dwelling species of *Anolis*: Are there adaptations for lower ultraviolet B and dietary vitamin D3 availability in the shade? *Physiological and Biochemical Zoology* 78:193–200.

Ferguson, G.W., J.B. Murphy, J.B. Ramanamanjato, and A.P. Raselimanana. 2004.*The Panther Chameleon. Color Variation, Natural History, Conservation, and Captive Management*. Malabar, FL: Grieger Publishing.

Filhol, H. 1877. Recherches sur les Phosphorites du Quercy. Pt. II. *Annales Sciences Géologiques* 8:1–338.

Fischer, M.S., Krause, C., and K.E. Lilje. 2010. Evolution of chameleon locomotion, or how to become arboreal as a reptile. *Zoology* 113(2):67–74.

Fisher, M.C., Henk, D.A., Briggs, C.J., Brownstein, J.S., Madoff, L.C., McCraw, S.L., and S.J. Gurr. 2012 Emerging fungal threats to animal, plant and ecosystem health. *Nature* 484:186–194.

Fitch, H.S. 1981. Sexual size differences in reptiles. *University of Kansas Museum of Natural History Miscellaneous Publication* 70:1–72.

Fitzinger, L. 1843. *Systema Reptilium, fasciculus primus, Amblyglossae*. Braumüller & Siedel: Wien.

Fitzsimons, V.F. 1943. Chamaeleonidae: the lizards of South Africa. *Transvaal Museum Memoirs* 1:151–174.

Fjeldså, J., and N.B. Burgess. 2008. The coincidence of biodiversity patterns and human settlement in Africa. *African Journal of Ecology* 46:33–42.

Fjeldså, J., and J.C. Lovett. 1997. Geographical patterns of old and young species in African forest biota: the significance of specific montane areas as evolutionary centres. *Biodiversity and Conservation* 6:322–346.

Flanders, M. 1985. Visually guided head movement in the African chameleon. *Vision Research* 25:935–942.

Fleishman, L.J. 1985. Cryptic movement in the vine snake *Oxybelis aeneus*. *Copeia* 1985:242–245.

Florio, A.M., C.M. Ingram, H.A. Rakotondravony, E.E. Louis Jr., and C.J. Raxworthy. 2012. Detecting cryptic diversity in the widespread and morphologically conservative carpet chameleon (*Furciferlateralis*) of Madagascar. *Journal of Evolutionary Biology* 25:1399–1414.

Forister, M.L., A.C. McCall, N.J. Sanders, J.A. Fordyce, J.H. Thorne, J. O'Brien, D.P. Waetjen, and A.M. Shapiro. 2010. Compounded effects of climate change and habitat alteration shift patterns of butterfly diversity. *Proceedings of the National Academy of Sciences of the United States of America* 107:2088–2092.

Foster, K.L., and T.E. Higham. 2012. How forelimb and hindlimb function changes with incline and perch diameter in the green anole (*Anolis carolinensis*). *Journal of Experimental Biology* 215(13):2288–2300.

Fournier, M., N. Chamot-Rooke, C. Petit, P. Huchon, A. Al-Kathiri, L. Audin, M.-O. Beslier, E. d'Acremont, O. Fabbri, J.-M. Fleury, K. Khanbari, C. Lepvrier, S. Leroy, B. Maillot and S. Merkouriev. 2010. Arabia-Somalia plate kinematics, evolution of the Aden-Owen-Carlsberg triple junction, and opening of the Gulf of Aden. *Journal of Geophysical Research* 115:B04102.

Fox, D.L. 1976. *Animal Biochromes and Structural Colours: Physical, Chemical, Distributional and Physiological Features of Coloured Bodies in the Animal World*. Berkeley: University of California Press.

Fox, H. 1977. The urogenital system of reptiles, pp. 1–157. In C. Gans and T.S. Parsons, Eds., *Biology of the Reptilia. Volume 6. Morphology E*. New York: Academic Press.

Frank, G.H. 1951. Contributions to the cranial morphology of *Rhampholeon platyceps* Günther. *Annale van die Uniwersiteit van Stellenbosch* 27(2):33–67.

Friis, I., S. Demissew, and P. van Breugel. 2010. Atlas of the potential vegetation of Ethiopia. Copenhagen: Royal Danish Academy of Science and Letters.

Frost, D.R., and R. Etheridge. 1989. A phylogenetic analysis and taxonomy of the iguanian lizards (Reptilia: Squamata). *University of Kansas Museum of Natural History Miscellaneous Publications* 81:1–65.

Frost, D. R., R. Etheridge, D. Janies, and T.A. Titus. 2001. Total evidence, sequence alignment, evolution of polychrotid lizards, and a reclassification of the iguania (Squamata: Iguania). *American Museum Novitates* 3343:1–38.

Furbringer, M. 1900. Zur vergleichenden Anatomie des Brustschulterapparates und der Schultermuskeln IV. *Jenaische Zeitschrift für Medizin und Naturwissenschaft* 34:215–718 [in German].

Gabe, M. 1970. The adrenal, pp. 263–318. In C. Gans and T.S. Parsons, Eds., *Biology of the Reptilia. Volume 3. Morphology C*. New York: Academic Press.

Gabe, M., and M. Martoja. 1961. Contribution a l'histologie de la glande surrénale des Squamata (Reptiles). *Archive d'Anatomie Microscopique et de Morphologie Experimentale* 50:1–34 [in French].

Gamble, T., A.M. Bauer, E. Greenbaum, and T.R. Jackman. 2008. Evidence for Gondwanan vicariance in an ancient clade of gecko lizards. *Journal of Biogeography* 35:88–104.

Gans, C. 1967. The chameleon. *Natural History* 76:52–59.

Gao, K., and D. Dashzeveg. 1999. New lizards from the Middle Eocene Mergen Formation of the Mongolian Gobi Desert. *Paläontologische Zeitschrift* 73:327–335.

Gao, K., and M. Norell. 2000. Taxonomic composition and systematics of Late Cretaceous lizard assemblages from Ukhaa Tolgod and adjacent localities, Mongolian Gobi desert. *Bulletin of the American Museum of Natural History* 249:1–118.

Garber, P.A., and J.A. Rehg. 1999. The ecological role of the prehensile tail in white-faced capuchins (*Cebus capucinus*). *American Journal of Physical Anthropology* 110:325–339.

García, G., and M. Vences. 2002. *Furcifer oustaleti* (Oustalet's chameleon). diet. *Herpetological Review* 33:134–135.

Garland, T. Jr., and J. B. Losos. 1994. Ecological morphology of locomotor performance in squamate reptiles, pp. 240–302. In P.C. Wainwright and S.M. Reilly, Eds., *Ecological Morphology: Integrative Organismal Biology*. Chicago: University of Chicago Press.

Gasc, J.-P. 1963. Adaptation a la marche arboricole chez le cameleon. *Archive d'Anatomie, d'Histologie et d'Embryologie Normales et Expérimentales* 46:81–115 [in Italian].

Gasc, J.-P. 1981. Axial Musculature, pp. 355–435. In C. Gans and T.S. Parsons, Eds., *Biology of the Reptilia. Volume 11. Morphology F*. New York: Academic Press.

Gaubert, P., and P. Cordeiro-Estrela. 2006. Phylogenetic systematics and tempo of evolution of the Viverrinae (Mammalia, Carnivora, Viverridae) within feliformians: implications for faunal exchanges between Asia and Africa. *Molecular Phylogenetics and Evolution* 41:266–278.

Gauthier, J.A., M. Kearney, J.A. Maisano, O. Rieppel, and D.B. Behlke. 2012. Assembling the squamate tree of life: perspectives from the phenotype and the fossil record. *Bulletin of the Peabody Museum of Natural History* 53:3–308.

GEF (Global Environmental Facility). 2002. Project Brief: Conservation and Management of the Eastern Arc Mountain Forests, Tanzania. Global Environmental Faciliity: Arusha, Tanzania.

Gehring, P.-S., and N. Lutzmann. 2011. Anmerkungen zum Zungentest-Verhalten bei Chamäleons. *Elaphe* 19(2):12–15 [in German].

Gehring, P.-S., N. Lutzmann, S. Furrer, and R. Sossinka. 2008. Habitat preferences and activity patterns of *Furcifer pardalis* (Cuvier, 1829) in the Masoala Rain Forest Hall of the Zurich Zoo. *Salamandra* 44:129–140

Gehring, P.-S., M. Pabijan, F.M. Ratsoavina, J. Köhler, M. Vences, and F. Glaw. 2010. A Tarzan yell for conservation: a new chameleon, *Calumma tarzan* sp. n., proposed as a flagship species for the creation of new nature reserves in Madagascar. *Salamandra* 46:167–179.

Gehring, P.S., F.M. Ratsoavina, M. Vences, and F. Glaw. 2011. *Calumma vohibola*, a new chameleon species (Squamata: Chamaeleonidae) from the littoral forests of eastern Madagascar. *African Journal of Herpetology* 60(2):130–154.

Gehring, P.-S., K.A. Tolley, F.S. Eckhardt, T.M. Townsend, T. Ziegler, F. Ratsoavina, F. Glaw, and M. Vences. 2012. Hiding deep in the trees: discovery of divergent mitochondrial lineages in Malagasy chameleons of the *Calumma nasutum* group. *Ecology and Evolution* 2:1468–1479.

Germershausen, G. 1913. Anatomische Untersuchungen über den Kehlkopf der Chamaeleonen. *Sitzungsberichte der Gesellschaft naturforschender Freunde zu Berlin* 1913:462–535 [in German].

Gheerbrandt, E., and J.C. Rage. 2006. Palaeobiogeography of Africa: how distinct from Gondwana and Laurasia. *Palaeogeography, Palaeoclimatology, Palaeoecology* 241:224–246.

Gilmore, C.W. 1943. Fossil lizards of Mongolia. *Bulletin of the American Museum of Natural History* 81(4):361–384.

Girdler, R.W., and P. Styles. 1978 Seafloor spreading in the western Gulf of Aden. *Nature* 271(5646):615–617.

Girons, H.S. 1970. The pituitary gland, pp. 135–199. In C. Gans and T.S. Parsons, Eds., *Biology of the Reptilia. Volume 3. Morphology C*. New York: Academic Press.

Glaw, F., J. Köhler, T.M. Townsend, and M. Vences. 2012. Rivaling the world's smallest reptiles: discovery of miniaturized and microendemic new species of leaf chameleons (*Brookesia*) from northern Madagascar. *PLoS ONE* 7:e31314.

Glaw, F., J. Köhler, and M. Vences. 2009. A distinctive new species of chameleon of the genus *Furcifer* (Squamata: Chamaeleonidae) from the Montagne d'Ambre rainforest of northern Madagascar. *Zootaxa* 2269:32–42.

Glaw, F., and M. Vences. 2007. *A Field Guide to the Amphibians and Reptiles of Madagascar*, 3rd ed. Köln, Germany: Vences and Glaw.

Glaw, F., M. Vences, T. Ziegler, W. Böhme, and J. Köhler. 1999. Specific distinctness and biogeography of the dwarf chameleons *Brookesia minima*, *B. peyrierasi* and *B. tuberculata* (Reptilia: Chamaeleonidae): evidence from hemipenal and external morphology. *Journal Zoology London* 247:225–238.

Gnanamuthu, C.P. 1930. The anatomy and mechanism of the tongue of *Chamaeleon carcaratus* (Merrem). *Proceedings of the Zoological Society of London* 31:467–486.

Gnanamuthu, C.P. 1937. Comparative study of the hyoid and tongue of some typical genera of reptiles. *Proceedings of the Zoological Society of London B* 107(1):1–63.

Goldby, F., and H.J. Gamble. 1957. The reptilian cerebral hemispheres. *Biological Reviews of the Cambridge Philosophical Society* 32:383–420.

Gonwouo, L.N., M. LeBreton, C. Wild, L. Chiro, P. Ngassam, and M.N. Tchamba. 2006. Geographic and ecological distribution of the endemic montane chameleons along the Cameroon mountain range. *Salamandra* 42:213–230.

Goodman, B.A., Miles, D.B., and L. Schwarzkopf. 2008. Life on the rocks: habitat use drives morphological and performance evolution in lizards. *Ecology* 89:3462–3471.

Goodman, S.M., and J.P. Benstead. 2003. *The Natural History of Madagasar*. Chicago: University of Chicago Press.

Goodman, S.M., and J.P. Benstead. 2005. Updated estimates of biotic diversity and endemism for Madagascar. *Oryx* 39:73–77.

Gordon, D.H., W. D. Haacke, and N.H.G. Jacobsen. 1987. Chromosomal studies of relationships in Gekkonidae, Chamaeleonidae and Scincidae in South Africa (abstract in Proceedings of the first HAA conference, Stellenbosch). *Journal of the Herpetological Association of Africa* 36:77.

Gray, J.E. 1865. Revision of the genera and species of Chamaeleonidae with the description of some new species. *Proceedings of the Zoological Society of London*1864:465–479.

Greenbaum, E., K.A. Tolley, A. Joma, and C. Kusamba. 2012. A new species of chameleon (Sauria: Chamaeleonidae: *Kinyongia*), from the Northern Albertine Rift, Central Africa. *Herpetologica* 68(1):60–75.

Griffiths, C.J. 1993. The geological evolution of East Africa, pp. 9–21. In J.C. Lovett and S.K. Wasser, Eds., *Biogeography and Ecology of the Rain Forests of Eastern Africa*. Cambridge, United Kingdom: Cambridge University Press.

Gugg, W. 1939. Der Skleralring der plagiotremen Reptilien. *Zoologische Jahrbücher. Abteilung für Anatomie und Ontogenie der Tiere* 65:339–416 [in German].

Gundy, G.C,. and G.Z. Wurst. 1976. The occurrence of parietal eyes in recent Lacertilia (Reptilia). *Journal of Herpetology* 10:113–121.

Guppy, M., and W. Davison. 1982. The hare and the tortoise: metabolic strategies in cardiac and skeletal muscles of the skink and the chameleon. *Journal of Experimental Zoology* 220:289–295.

Haagner, G.V., and W.R. Branch. 1993. Notes on predation on some Cape dwarf chameleons. *The Chameleon* 1:9–10.

Haas, G. 1937. The structure of the nasal cavity in *Chamaeleo chamaeleon* (Linnaeus). *Journal of Morphology* 61(3):433–451.

Haas, G. 1947. Jacobsons organ in the chameleon. *Journal of Morphology* 81(2):195–207.

Haas, G. 1952. The fauna of layer B of the Abu Usba Cave. *Israel Exploration Journal* 2:35–47.

Haas, G. 1973. Muscles of the Jaws and Associated Structures in the Rhynchocephalia and Squamata, pp. 285–490. In C. Gans and T.S. Parsons, Eds., *Biology of the Reptilia. Volume 4. Morphology D*. New York: Academic Press.

Hagey, T.J., J.B. Losos, and L.J. Harmon. 2010. Cruise foraging of invasive chameleon (*Chamaeleo jacksonii xantholophus*) in Hawai'i. *Breviora* 519:1–7.

Haines, R.W. 1952. The shoulder joint of lizards and the primitive reptilian shoulder mechanism. *Journal of Anatomy* 86:412–422.

Haker, H., H. Misslich, M. Ott, M.A. Frens, V. Henn, K. Hess, and P.S. Sandor. 2003. Three-dimensional vestibular eye and head reflexes of the chameleon: characteristics of gain and phase and effects of eye position on orientation of ocular rotation axes during stimulation in yaw direction. *Journal of Comparative Physiology A* 189: 509–517.

Hale, M.E. 1996. Functional morphology of ventral tail bending and prehensile abilities of the seahorse, *Hippocampus kuda*. *Journal of Morphology* 227:51–65.

Hall, J., Burgess, N.D., Lovett, J., Mbilinyi, B., and R.E. Gereau. 2009. Conservation implications of deforestation across an elevational gradient in the Eastern Arc Mountains, Tanzania. *Biological Conservation* 142:2510–2521.

Hallermann, J. 1994. Zur morphologie der ethmoedalregion der Iguania (Squamata); eine vergleichend-anatomische Untersuchung. *Bonner Zoologische Monographien* 35:1–133 [in German with English summary].

Halpern, M. 1992. Nasal chemical senses in reptiles: Structure and function. Pp 424–532 in C. Gans and D. Crews, Eds., *Biology of the Reptilia, Volume 18, Physiology E*. Chicago: University of Chicago Press.

Harkness, L. 1977. Chameleons use accommodation cues to judge distance. *Nature* 267(5609):346–349.

Hart, N.S. 2001. The visual ecology of avian photoreceptors. *Progress in Retinal and Eye Research* 20:675–703.

Hawlitschek, O., B. Brückmann, J. Berger, K. Green, and F. Glaw. 2011. Integrating field surveys and remote sensing data to study distribution, habitat use, and conservation status of the herpetofauna of the Comoro Islands. *Zookeys* 144:21–79.

Hazard, L.C. 2004. Sodium and potassium secretion by Iguana salt glands, pp. 84–93. In A.C. Alberts, R.L. Carter, W.K. Hayes and E.P. Martins, Eds. *Iguanas: Biology and Conservation*. Berkeley: University of California Press.

Heads, M. 2005. Dating nodes on molecular phylogenies: a criteque of molecular biogeography. *Cladistics 21:62–78*.

Hébert, H., C. Deplus, P. Huchon, K. Khanbari and L. Audin. 2001. Lithospheric structure of a nascent spreading ridge inferred from gravity data: the western Gulf of Aden *Journal of Geophysical Research* 106:B11.

Hebrard, J.J. 1980. Habitats and sleeping perches of three species of chameleon in Kenya. *American Zoology* 20:842.

Hebrard, J.J., and T. Madsen. 1984. Dry season intersexual habitat partitioning by flap-necked chameleons (*Chamaeleo dilepis*) in Kenya. *Biotropica* 16:69–72.

Hebrard, J.L., S.M. Reilly, and M. Guppy. 1982. Thermal ecology of *Chameleo hoehnelii* and *Mabuya varia* in the Aberdare mountains: constraints of heterothermy in an alpine habitat. *Journal of the East African Natural History Society* 176:1–6.

Hecht, M., and R. Hoffstetter. 1962. Note préliminaire sur les amphibiens et les squamates du Landenien supérieur et du Tongrien de Belgique. *Bulletin de l'Institut Royal des Sciences Naturelles de Belgique* 39:1–30 [in French].

Hedges, B.S., and N. Vidal. 2009. Lizards, snakes, and amphisbaenians (Squamata), pp. 383–389. In B.S. Hedges and S. Kumar, Eds., *The Timetree of Life*. New York: Oxford University Press.

Herrel, A. 2007. Herbivory and foraging mode in lizards, pp. 209-236 In S.M. Reilly, L.D. McBrayer and D.B. Miles, Eds., *Lizard Ecology: The evolutionary consequences of foraging mode*. Cambridge: Cambridge University Press.

Herrel, A., S.M. Deban, V. Schaerlaeken, J.-P. Timmermans, and D. Adriaens. 2009. Are morphological specializations of the hyolingual system in chameleons and salamanders tuned to demands on performance? *Physiological and Biochemical Zoology* 82(1):29–39.

Herrel, A., R.S. James, and R. Van Damme. 2007a. Fight versus flight: Physiological basis for temperature-dependent behavioral shifts in lizards. *Journal of Experimental Biology* 210 (10):1762–1767.

Herrel, A., G.J. Measey, B. Vanhooydonck, and K.A. Tolley. 2011. Functional consequences of morphological differentiation between populations of the Cape Dwarf Chameleon (*Bradypodion pumilum*). *Biological Journal of the Linnean Society* 104:692–700.

Herrel, A., G.J. Measey, B. Vanhooydonck, and K.A. Tolley. 2012. Got it clipped? The effect of tail clipping on tail gripping performance in chameleons. *Journal of Herpetology* 46 (1):91–93.

Herrel, A., J.J. Meyers, P. Aerts, and K.C. Nishikawa. 2000. The mechanics of prey prehension in chameleons. *Journal of Experimental Biology* 203(21):3255–3263.

Herrel, A., J.J. Meyers, P. Aerts, and K.C. Nishikawa. 2001a. Functional implications of supercontracting muscle in the chameleon tongue retractors. *Journal of Experimental Biology* 204 (21):3621–3627.

Herrel, A., J.J. Meyers, K.C. Nishikawa, and F. De Vree. 2001b. Morphology and histochemistry of the hyolingual apparatus in chameleons. *Journal of Morphology* 249(2):154–170.

Herrel, A., J.J. Meyers, J.-P. Timmermans, and K.C. Nishikawa. 2002. Supercontracting muscle: producing tension over extreme muscle lengths. *Journal of Experimental Biology* 205: 2167–2173.

Herrel, A., V. Schaerlaeken, J.J. Meyers, K.A. Metzger, and C.F. Ross. 2007b. The evolution of cranial design and performance in squamates: consequences of skull-bone reduction on feeding behavior. *Integrative and Comparative Biology* 47:107–117.

Herrel, A., K.A. Tolley, G.J. Measey, J.M. daSilva, D.F. Potgieter, R. Biostel, and B. Vanhooydonck. 2013. Slow but tenacious: an analysis of running and gripping performance in chameleons. *Journal of Experimental Biology* 216:1025–1030.

Herrmann, P.A., and H.W. Herrmann. 2005. Egg and clutch characteristics of the mountain chameleon, *Chamaeleo montium*, in southwestern Cameroon. *Journal of Herpetology* 39:154–157.

Higham, T.E., M.S. Davenport, and B.C. Jayne. 2001. Maneuvering in an arboreal habitat: the effects of turning angle on the locomotion of three sympatric ecomorphs of *Anolis* lizards. *Journal of Experimental Biology* 204 (23):4141–4155.

Higham, T.E., and B.C. Jayne. 2004a. *In vivo* muscle activity in the hindlimb of the arboreal lizard, *Chamaeleo calyptratus*: general patterns and effects of incline. *Journal of Experimental Biology* 207(2):249–261.

Higham, T.E., and B.C. Jayne. 2004b. Locomotion of lizards on inclines and perches: hindlimb kinematics of an arboreal specialist and a terrestrial generalist. *Journal of Experimental Biology* 207(2):233–248.

Higham, T.E., and A.P. Russell. 2010. Divergence in locomotor performance, ecology, and morphology between two sympatric sister species of desert-dwelling gecko. *Biological Journal of the Linnean Society* 101:860–869.

Hill, A.V. 1950. The dimensions of animals and their muscular dynamics. *Science Progress* 38:209–230.

Hillenius, D. 1959. The differentiation within the genus *Chamaeleo* Laurenti 1768. *Beaufortia*, 8(89):1–92.

Hillenius, D. 1978a. Notes on chameleons. IV: A new chameleon form the Miocene of Fort Ternan, Kenya (Chamaeleonidae, Reptilia). *Beaufortia* 28:9–15.

Hillenius, D. 1978b. Notes on chameleons. V: The chameleons of north Africa and adjacent countries, *Chamaeleo chamaleon* (Linnaeus) (Sauria, Chamaeleonidae). *Beaufortia* 28:37–55.

Hillenius, D. 1986. The relationship of *Brookesia*, *Rhampholeon* and *Chamaeleo* (Chamaeleonidae, Reptilia). *Bijdragen tot de Dierkunde* 56(1):29–38.

Hillenius, D. 1988. The skull of *Chamaeleo nasutus* adds more information to the relationship of *Chamaeleo* with *Rhampholeon* and *Brookesia* (Chamaeleonidae, Reptilia). *Bijdragen Tot De Dierkunde* 58(1):7–11.

Hockey, P.A.R., W.R.J. Dean, and P.G. Ryan. 2005. *Roberts—Birds of Southern Africa*, 7th ed. Cape Town, South Africa: Trustees of the John Voelcker Bird Book Fund.

Hódar, J.A., J.M. Pleguezuelos, and J.C. Poveda. 2000. Habitat selection of the common chameleon (*Chamaeleo chamaeleon*) (L.) in an area under development in southern Spain: implications for conservation. *Biological Conservation* 94: 63–68.

Hofer, U., H. Baur, and L.-F. Bersier. 2003. Ecology of three sympatric species of the genus *Chamaeleo* in a tropical upland forest in Cameroon. *Journal of Herpetology* 37(1):203–207.

Hoffmann, M., C. Hilton-Taylor, A. Angulo, M. Böhm, T.M. Brooks, S.H.M. Butchart, K.E. Carpenter, J. Chanson, B. Collen, N.A. Cox, et al. 2010. The impact of conservation on the status of the world's vertebrates. *Science* 330:1503–1509.

Hoffstetter, R. 1967. Coup d'oeil sur les Sauriens (Lacertiliens) des couches de Purbeck (Jurassique supérieur d'Angleterre, Résumé d'un mémoire). *Colloque international du CNRS* 163:349–371 [in French].

Hoffstetter, R., and J.-P.Gasc. 1969. Vertebrae and Ribs of Modern Reptiles. Pp. 201–310 in C. Gans, Ed., *Biology of the Reptilia. Volume 1. Morphology A*. New York: Academic Press.

Hofman, A., L.R. Maxon, and J.W. Arntzen. 1991. Biochemical evidence pertaining to the taxonomic relationships within the family Chamaeleonidae. *Amphibia-Reptilia* 12:245–265.

Hogben, L., and D. Slome. 1931. The pigmentary effector system VI. The dual character of endocrine co-ordination in amphibian color change. *Proceedings of the Royal Society of London, Series B—Biological Sciences* 108:10–53.

Hogben, L.T., and L. Mirvish. 1928. The pigmentary effector system. V. The nervous control of excitement pallor in reptiles. *Journal of Experimental Biology* 5:295–308.

Holmes, RB., A.M. Murray, P. Chatrath, Y.S. Attia, and E.L. Simons. 2010. Agamid lizard (Agamidae: Uromastycinae) from the lower Oligocene of Egypt. *Historical Biology* 22:215–223.

Honda, M., H. Ota, M. Kobayashi, J. Nabhitabhata, H.-S. Yong, S. Sengoku, and T. Hikida. 2000. Phylogenetic relationships of the family Agamidae (Reptilia: Iguania) inferred from mitochondrial DNA sequences. *Zoological Science* 17:527–537.

Hooijer, D.A. 1961. The fossil vertebrates of Ksâr'Akil, a Palaeolithic rock shelter in the Lebanon. *Zoologische Verhandellingen* 49:3–67.

Hopkins, K.P., and K.A. Tolley. 2011. Morphological variation in the Cape Dwarf Chameleon (*Bradypodion pumilum*) as a consequence of spatially explicit habitat structure differences. *Biological Journal of the Linnean Society* 102(4):878–888.

Hou, L. 1974. Paleocene Lizards from Anhui, China. *Vertebrata PalAsiatica* 12(3):193–202.

Hou, L. 1976. New Materials of Palaeocene Lizards of Anhui. *Vertebrata PalAsiatica* 14(1):48–52.

Houniet, D.T., W. Thuiller, and K.A. Tolley. 2009. Potential effects of predicted climate change on the endemic South African Dwarf Chameleons, *Bradypodion*. *African Journal of Herpetology* 59:28–35.

Houston, J. 1828. On the structure and mechanism of the tongue of the chameleon. *Transactions of the Royal Irish Academy* 15:177–201.

Huey, R.B., and A.F. Bennett. 1987. Phylogenetic studies of coadaptation: Preferred temperatures versus optimal performance temperatures of lizards. *Evolution* 41 (5):10 98–1115.

Huey, R. B., C. A. Deutsch, J. J. Tewksbury, L. J. Vitt, P. E. Hertz, H. J. Álvarez-Pérez, and T. Garland Jr. 2009. Why tropical forest lizards are vulnerable to climate warming. *Proceedings of the Royal Society London, B* 276:1939–1948.

Huey, R.B., and E.R. Pianka. 1981. Ecological consequences of foraging mode. *Ecology* 62:991–999.

Huey, R.B., and R.D. Stevenson. 1979. Integrating thermal physiology and ecology of ectotherms: A discussion of approaches. *American Zoologist* 19:357–366.

Hugall, A.F., R. Foster, M. Hutchinson, and M.S.Y. Lee. 2008. Phylogeny of Australian agamid lizards based on nuclear and mitichondrial genes: implications for morphological evolution and biogeography. *Biological Journal of the Linnean Society* 93:343–358.

Hugall, A.F., and M.S.Y. Lee. 2004. Molecular claims of Gondwanan age for Australian agamid lizards are untenable. *Molecular Biology and Evolution* 21(11):2102–2110.

Humphreys C.W. 1990. Observations on nest excavations, egg laying and the incubation period of Marshall's Dwarf Chameleon *Rhampholeon marshalli* Boulenger 1906. *Zimbabwe Science News* 24(1/3):3–4.

Hunt, D.M., S.E. Wilkie, J.K. Bowmaker, and S. Poopalasundaram. 2001. Vision in the ultraviolet. *Cellular and Molecular Life Sciences* 58:1583–1598.

Hurle, J.M., Garcia-Martinez, V., Ganan, Y., Climent, V. and M. Blasco. 1987. Morphogenesis of the prehensile autopodium in the common chameleon (*Chamaeleo chamaeleo*). *Journal of Morphology* 194 (2):187–194.

Hutchinson, M.N., A. Skinner, and M.S.Y. Lee. 2012. *Tikiguania* and the antiquity of squamate reptiles (lizards and snakes). *Biology Letters* 8 (4):665–669.

Ingram, J.C., and T.P. Dawson. 2005. Climate change impacts and vegetation response on the island of Madagascar. *Philosophical Transactions of the Royal Society A* 363:55–59.

Intergovernmental Panel on Climate Change (IPCC). 2007. *Fourth Assessment Report: Climate Change 2007, The Physical Science Basis*. Cambridge, United Kingdom: Cambridge University Press.

Intergovernmental Panel on Climate Change (IPCC). 2011. IPCC SREX Summary for Policymakers. Accessed at www.ipcc.ch/news_and_events/docs/ipcc34/SREX_FD_SPM_final.pdf on November 21, 2011.

Irschick, D.J., C.C. Austin, K. Petren, R.N. Fisher, J.B. Losos, and O. Ellers. 1996. A comparative analysis of clinging ability among pad-bearing lizards. *Biological Journal of the Linnean Society* 59:21–35.

Irschick, D.J., and J.B. Losos. 1998. A comparative analysis of the ecological significance of maximal locomotor performance in Caribbean *Anolis* lizards. *Evolution* 52:219–226.

Irschick, D.J., T.E. Macrini, S. Koruba, and J. Forman. 2000. Ontogenetic differences in morphology, habitat use, behavior, and sprinting capacity in two West Indian Anolis lizards. *Journal of Herpetology* 34(3):444–451.

Irwin, M.T., P.C. Wright, C. Birkinshaw, B.L. Fisher, C.J. Gardner, J. Glos, S.M. Goodman, P. Loiselle, P. Rabeson, J.-L. Raharison, M.J. Raherilalao, D. Rakotondravony, A. Raselimanana, J. Ratsimbazafy, J.S. Sparks, L. Wilmé, L., and J.U. Ganzhorn. 2010. Patterns of species change in anthropogenically disturbed forests of Madagascar. *Biological Conservation* 143:2351–2362.

IUCN. 2012. IUCN Red List of Threatened Species. Version 2012.1. Accessed at www.iucnredlist.org on June 19, 2012.

Jackson, J.C. 2007. Reproduction in dwarf chameleons (*Bradypodion*) with particular reference to *B. pumilum* occurring in fire-prone fynbos habitat. Ph.D. thesis. University of Stellenbosch, South Africa.

Jackson, J.F. 1973. Distribution and population phenetics of the Florida scrub lizard, Sceoloporus woodi. *Copeia* 1973:746–761.

Jacobs, B.F. 2004. Palaeobotanical studies from tropical Africa: relevance to the evolution of forest, woodland and savannah biomes. *Philosophical Transactions of the Royal Society of London Series B-Biological Sciences* 359:1573–1583.

Janzen, D.H. 1967. Why mountain passes are higher in the tropics? *American Naturalist* 101:233–249.

Jenkins, R.K.B., L.D. Brady, M. Bisoa, J. Rabearivonyc, and R.A. Griffiths. 2003. Forest disturbance and river proximity influence chameleon abundance in Madagascar. *Biological Conservation* 109:407–415.

Jenkins, R.K.B., L.D. Brady, K. Huston, J.L.D. Kauffmann, J. Rabearivony, G. Raveloson, and M. Rowcliffe. 1999. The population status of chameleons within Ranomafana National Park, Madagascar. *Oryx* 33:38–47.

Jenkins, R.K.B., J. Rabearivony, and H. Rakotomanana. 2009. Predation on chameleons in Madagascar: a review. *African Journal of Herpetology* 58:131–136.
Jha, S., and K.S. Bawa. 2006. Population growth, human development, and deforestation in biodiversity hotspots. *Conservation Biology* 20:906–912.
Johnson, M.K., and A.P. Russell. 2009. Configuration of the setal fields of *Rhoptropus* (Gekkota: Gekkonidae): functional, evolutionary, ecological and phylogenetic implications of observed pattern. *Journal of Anatomy* 214:937–955.
Jollie, M. 1962. *Chordate Morphology*. New York: Reinhold Publishing.
Joshi, M., and B.S. Kotlia. 2010. First Report of the Late Pleistocene fossil lizards from Narmada Basin, Central India. *Earth Science India* 3(1):1–8.
Källén, B. 1951a. Contributions to the knowledge of the medial wall of the reptilian forebrain. *Acta Anatomy* 13:90–100.
Källén, B. 1951b. On the ontogeny of the reptilian forebrain. Nuclear structures and ventricular sulci. *Journal of Comparative Neurology* 95:307–347.
Kaloloha, A., C. Misandeau, and P.-S. Gehring. 2011. Notes on the diversity and natural history of the snake fauna of Ambodiriana—Manompana, a protected rainforest site in north-eastern Madagascar. *Herpetology Notes* 4:397–402.
Karsten, K.B., L.N. Andriamandimbiarisoa, S.F. Fox, and C.J. Raxworthy. 2008. A unique life history among tetrapods: An annual chameleon living mostly as an egg. *Proceedings of the National Academy of Sciences of the United States of America* 105:8980–8984.
Karsten, K.B., L.N. Andriamandimbiarisoa, S.F. Fox, and C.J. Raxworthy. 2009b. Population densities and conservation assessments for three species of chameleons in the Toliara region of southwestern Madagascar. *Amphibia-Reptilia* 30:341–350.
Karsten, K.B., L.N. Andriamandimbiarisoa, S.F. Fox, and C.J. Raxworthy. 2009c. Social behavior of two species of chameleons in Madagascar: insights into sexual selection. *Herpetologica* 65:54–69.
Karsten, K.B., G.W. Ferguson, T.C. Chen, and M.F. Holick. 2009a. Panther chameleons, *Furcifer pardalis*, behaviorally regulate optimal exposure to UV on dietary vitamin D3 status. *Physiological and Biochemical Zoology* 82:218–225.
Kashyap, H.V. 1960. Morphology of the reptilian heart. *Bulletin of the Zoological Society of India, Nagpur* 3:23–34.
Kassarov, L. 2003. Are birds the primary selective force leading to evolution of mimicry and aposematism in butterflies? An opposing point of view. *Behaviour* 140:433–451.
Kathariner, L. 1894. Anatomie und Mechanismus der Zunge der Vermilinguier. *Jenaische Zeitschrift für Medizin und Naturwissenschaft* 29:247–270 [in German].
Kauffmann, J.L.D., L.D. Brady, and R.K.B. Jenkins. 1997. Behavioural observations of the chameleon *Calumma oshaughnessyi oshaughnessyi* in Madagascar. *Herpetological Journal* 7:77–80.
Kearney, M., and W. Porter. 2009. Mechanistic niche modelling: combining physiological and spatial data to predict species' ranges. *Ecology Letters* 12:334–350.
Kelso, E.C., and P.A. Verrell. 2002. Do male veiled chameleons, *Chamaeleo calyptratus*, adjust their courtship displays in response to female reproductive status? *Ethology* 108:495–512.
Keren-Rotem, T., A. Bouskila, and E. Geffen. 2006. Ontogenetic habitat shift and risk of cannibalism in the common chameleon (*Chamaeleo chamaeleon*). *Behavioral Ecology and Sociobiology* 59:723–731.
Kirmse, W., R. Kirmse, and E. Milev. 1994. Visuomotor operation in transition from object fixation to prey shooting in chameleons. *Biological Cybernetics* 71:209–214.

Klaver, C. 1979. A review of *Brookesia* systematics with special reference to lung morphology. *Bonner Zoologische Beiträge* 30:163–175.

Klaver, C., and W. Böhme. 1986. Phylogeny and classification of the Chamaeleonidae (Sauria) with special reference to hemipenis morphology. *Bonner Zoologische Monographien* 22:1–64.

Klaver, C., and W. Böhme. 1992. The species of the *Chamaeleo cristatus* group from Cameroon and adjacent countries, West Africa. *Bonn Zoological Bulletin* 43:433–476.

Klaver, C.J.J. 1973. Lung anatomy: aid in chameleon-taxonomy. *Beaufortia* 20(269):155–177.

Klaver, C.J.J. 1977. Comparative lung-morphology in the genus *Chamaeleo* Laurenti, 1768 (Sauria: Chamaeleonidae) with a discussion of taxonomic and zoogeographic implications. *Beaufortia* 25(327):167–199.

Klaver, C.J.J. 1979. A review of *Brookesia* systematics with special reference to lung morphology. *Bonner Zoologishe Beiträge Heft* 1–2(30):163–175.

Klaver, C.J.J. 1981. Lung morphology in the Chamaeleonidae (Sauria) and its bearing upon phylogeny, systematics and zoogeography. *Zeitschrift fuer Zoologische Systematik und Evolutionsforschung* 19:36–58.

Klaver, C.J.J., and W. Böhme. 1997. Chamaeleonidae. *Das Tierreich* 112, I-XV:1–85.

Knoll, A., F. Glaw, and J. Köhler. 2009. The Malagasy snake *Pseudoxyrhopus ambreensis* preys upon chameleon eggs by shell slitting. *Herpetology Notes* 2:161–162.

Koreny, L. 2006. *Phylogeny of East-African chameleons*. MSc thesis, Faculty of Biological Sciences, University of South Bohemia, Ceske Budejovice.

Kosuch, J., M. Vences, and W. Böhme. 1999. Mitochondrial DNA sequence data support the allocation of Greek mainland chameleons to *Chamaeleo africanus*. *Amphibia-Reptilia* 20:440–443.

Kraus, F., A. Medeiros, D. Preston, C.S. Jarnevich, and G.H. Rodda. 2012. Diet and conservation implications of an invasive chameleon, *Chamaeleo jacksonii* (Squamata: Chamaeleonidae) in Hawaii. *Biological Invasions* 14:579–593.

Krause, C., and M.S. Fischer. 2013. Biodynamics of climbing: effects of substrate orientation on the locomotion of a highly arboreal lizard (*Chamaeleo calyptratus*). *Journal of Experimental Biology* 216(18)1448–1457.

Krause, D.W., S.E. Evans, and K. Gao. 2003. First definitive record of a Mesozoic lizard from Madagascar. *Journal of Vertebrate Paleontology* 23(4):842–856.

Krause, D.W., R.R. Rogers, C.A. Forster, J.H. Hartman, J.H. Buckley, and S.D. Sampson. 1999. The Late Cretaceous vertebrate fauna of Madagascar: implications for Gondwanan paleobiogeography. *GSA Today* 9:1–7.

Kumazawa, Y. 2007. Mitochondrial genomes from major lizard families suggest their phylogenetic relationships and ancient radiations. *Gene* 388:19–26.

Laffan, S.W., E. Lubarsky, and D.F. Rosauer. 2010. Biodiverse, a tool for the spatial analysis of biological and related diversity. *Ecography* 33:643–647 (version 0.14).

Lakjer, T. 1926. Studien über die Trigeminus-versorgte Kaumuskulatur der Sauropsiden. Copenhagen: C.A. Reitzel [in German].

Land, M.F. 1995. Fast-focus telephoto eye. *Nature* 373:658–659.

Largen, M.J., and S. Spawls. 2010. The amphibians of Ethiopia and Eritrea. Frankfurt am Main, Germany: Edition Chimaira.

Le Berre, F. 1995. *The new chameleon handbook*. Barron's: Hong Kong, China.

Le Gall, B., P. Nonnotte, J. Rolet, M. Benoit, H. Guillou, M. Mousseau-Nonnotte, J. Albaric, and J. Deverchère. 2008. Rift propagation at craton margin: distribution of faulting and volcanism in the North Tanzanian divergence (East Africa) during Neogene times. *Tectonophysics* 448:1–19.

Leakey, L.S.B. 1965. *Olduvai Gorge 1951–1961. Vol.1. A preliminary report on the geology and fauna*. Cambridge, United Kingdom: Cambridge University Press.

Leblanc, E. 1924. Les muscles orbitaires des reptiles. Étude des muscles chez *Chameleo vulgaris. Comptes Rendus de l'Académie des Sciences Paris* 179:996–998 [in French].

Leblanc, E. 1925. Les muscles orbitaires des reptiles. Étude des muscles chez *Chamaeleo vulgaris. Bulletin de la Société d'Histoire Naturelle d'Afrique du Nord* 16 :49–61 [in French].

Lecuru, S. 1968a. Etude des variations morphologiques du sternum, des clavicules et de l'interclavicule des lacertiliens. *Annales des Sciences Naturelles: Zoologie et Biologie Animale. Série 12* 10:511–544 [in French].

Lecuru, S. 1968b. Remarques sur le scapulo-coracoide des lacertiliens. *Annales des Sciences Naturelles: Zoologie et Biologie Animale. Série 12* 10:475–510 [in French].

Lee, D.-C., A.N. Halliday, J.G. Fitton, and G. Poli. 1994. Isotopic variations with distance and time in the volcanic islands of the Cameroon line: evidence for a mantle plume origin. *Earth and Planetary Science Letters* 123:119–138.

Leidy, J. 1872. Remarks on fossils from Wyoming. *Proceedings of the Natural Academy of Sciences of Philadelphia* 1872:122.

Leidy, J. 1873. Contributions to the extinct vertebrate fauna of western territories. *Report of the United States Geological Survey of the Territories* 1:14–358.

Lever, C. 2003. *Naturalized Reptiles and Amphibians of the World*. New York: Oxford University Press.

Li, J. 1991a. Fossil reptiles from Hetaoyuan Formation, Xichuan, Henan. *Vertebrata PalAsiatica* 29(3):190–203.

Li, J. 1991b. Fossil reptiles from Zhaili Member, Hedi Formation, Yuanqu, Shanxi. *Vertebrata PalAsiatica* 29(4):276–285.

Li, P.P., K. Gao, L.-H. Hou, and X. Xu. 2007. A gliding lizard from the Early Cretaceous of China. *Proceedings of the National Academy of Sciences of the United States of America* 104(13):5507–5509.

Lin, E.J.I., and C.E. Nelson. 1981. Comparative reproductive biology of two sympatric tropical lizards, *Chamaeleo jacksonii* Boulenger and *Chamaeleo hoehnelii* Steindachner (Sauria: Chamaeleonidae). *Amphibia-Reptilia* 3/4:287–311.

Lin, J. 1980. Desiccation tolerance and thermal maxima in the lizards. *Chamaeleo jacksoni* and *C. hohneli. Copeia* 1980:363–366.

Lin, J., and C.E. Nelson. 1980. Comparative reproductive biology of two sympatric tropical lizards *Chamaeleo jacksonii* Boulenger and *Chamaeleo hoehnelii* Steindachner (Sauria: Chamaeleonidae). *Amphibia-Reptilia* 1:287–311.

Linder, H.P., H.M. de Klerk, J. Born, N.D. Burgess, J. Fjeldså, and C. Rahbek. 2012. The partitioning of Africa: statistically defined biogeographical regions in sub-Saharan Africa. *Journal of Biogeography* 39:1189–1205.

Linder, H.P., J. Lovett, J.M. Mutke, W. Barthlott, N. Jürgens, T. Rebelo, and W. Küper. 2005. A numerical re-evaluation of the sub-Saharan phytochoria of mainland Africa. *Biologiske Skrifter* 55:229–252.

Lloyd, C.N.V. 1974. Feeding behaviour in the green mamba, *Dendroaspis angusticpes* (A. Smith). *Journal of the Herpetological Association of Africa* 12:1–12.

Loader, S.P., D.J. Gower, K.M. Howell, N. Doggart, M.O. Rödel, B.T. Clarke, R.O. de Sá, B.L. Cohen, and M. Wilkinson. 2004. Phylogenetic relationships of African Microhylid frogs inferred from DNA sequences of mitochondrial 12S and 16S ribosomal rRNA genes. *Organisms Diversity and Evolution* 4:227–235.

Losos, J.B. 1990. The evolution of form and function: morphology and locomotor performance in West Indian *Anolis* lizards. *Evolution* 44(5):1189–1203.

Losos, J.B., and D.L. Mahler. 2011. Adaptive radiation: the interaction of ecological opportunity, adaptation, and speciation, pp. 381–420. In M.A. Bell, D.J. Futuyma, W.F. Eanes and J.S. Levinton, Eds., *Evolution Since Darwin: The First 150 Years*. Sunderland, MA: Sinauer Associates.

Losos, J.B., and B. Sinervo. 1989. The effects of morphology and perch diameter on sprint performance of *Anolis* lizards. *Journal of Experimental Biology* 145:23–30.

Losos, J.B., B.M. Walton, and A.F. Bennett. 1993. Trade-offs between sprinting and clinging ability in Kenyan chameleons. *Functional Ecology* 7:281–286.

Loveridge, A. 1923. Notes on East African snakes, collected 1918–1923. *Proceedings of the Zoological Society of London* 1923:871–897.

Loveridge, A. 1953. Zoological results of a fifth expedition to East Africa III. Reptiles from Nyasaland and Tete. *Bulletin of the Museum of Comparative Zoology* 110:143–322.

Loveridge A. 1957. Checklist of the reptiles and amphibians of East Africa (Uganda, Kenya, Tanganyika, Zanzibar). *Bulletin of the Museum of Comparative Zoology (Harvard)* 117(2):153–362.

Lovett, J.C. 1993. Climatic history and forest distribution in eastern Africa. Pp. 23–29 in J.C. Lovett and S. Wasser, Eds., *Biogeography and ecology of the rain forests of Eastern Africa*. Cambridge, United Kingdom: Cambridge University Press.

Lovett J.C. and S.K. Wasser. 1993. *Biogeography and ecology of the rain forests of eastern Africa*. Cambridge University Press: Cambridge.

Lowin, A.J. 2012. Chameleon species composition and density estimates of three unprotected dry deciduous forests between Montagne d'Ambre Parc National and Ankarana Réserve Spéciale in northern Madagascar. *Herpetology Notes* 5:107–113.

Lubosch, W. 1932. Bemerkungen über die Zungenmuskulatur des Chamäleons. *Morphologisches Jahrbuch* 71:158–170 [in German].

Lubosch, W. 1933. Untersuchunden über die Visceralmuskulatur der Sauropsiden. *Gegenbaurs. Morphologisches Jahrbuch* 72:584–666 [in German].

Luiselli, L. 2006. Nonrandom co-occurrence patterns of rainforest chameleons. *African Journal of Ecology* 45:336–346.

Luiselli, L., F.M. Angelici, and G.C. Akani. 2000. Reproductive ecology and diet of the Afro-tropical tree snake *Rhamnophis aethiopissa* (Colubridae). *Herpetological Natural History* 7:163–171.

Luiselli, L., G.C. Akani, and F.M. Angelici. 2001. Diet and foraging behaviour of three ecologically little-known African forest snakes: *Meizodon coronatus, Dipsadoboa duchesnei* and *Hapsidophrys lineatus*. *Folia Zoologica* 50:151–158.

Luiselli, L., and L. Rugiero. 1996. *Chamaeleo chamaeleon*. Diet. *Herpetological Review* 27:78–79.

Luppa, H. 1977. Histology of the digestive tract, pp. 225–313. In C. Gans and T.S. Parsons, Eds., *Biology of the Reptilia. Volume 6. Morphology E*. New York: Academic Press.

Lutz, G.J., and L.C. Rome. 1996. Muscle function during jumping in frogs, II. Mechanical properties of muscle: implications for system design. *American Journal of Physiology* 271(2 Pt 1):C571-C578.

Lutzmann, N. 2000. Phytophagie bei Chamäleons. *Draco* 1:82.

Lutzmann, N. 2004. Females carrying males in chameleon courtship. *Reptilia (GB)* 35:34–36.

Lynn, W.G. 1970. The thyroid, pp. 201–234. In C. Gans and T.S. Parsons, Eds., *Biology of the Reptilia. Volume 3. Morphology C*. New York: Academic Press.

Lynn, W.G., and G.A. Walsh. 1957. The morphology of the thyroid gland in the Lacertilia. *Herpetologica* 13(3):157–162.

Macey, J.R., Kuehl, J.V., Larson, A., Robinson, M.D., Ugurtas, I.H., Ananjeva, N.B., Rahman, H., Javed, H.I., Osman, R.M., Doumma, A. and T.J. Papenfuss. 2008. Socotra Island the forgotten fragment of Gondwana: unmasking chameleon lizard history with complete mitochondrial genomic data. *Molecular Phylogenetics and Evolution* 49:1015–8.

Macey, J.R., A. Larson, N.B. Ananjeva, Z. Fang, and T.J. Papenfuss. 1997a. Two novel gene orders and the role of light-strand replication in rearrangement of the vertebrate mitochondrial genome. *Molecular Biology and Evolution* 14:91–104.

Macey, J.R., A. Larson, N.B. Ananjeva, and T.J. Papenfuss. 1997b. Evolutionary shifts in three major structural features of the mitochodrial genome among iguanian lizards. *Journal of Molecular Evolution* 44:660–674.

Macey, J.R., J.A. Schulte II, and A. Larson. 2000a. Evolution and phylogenetic information content of mitochondrial genomic structural features illustrated with acrodont lizards. *Systematic Biology* 49(2):257–277.

Macey, J.R., J.A. Schulte II, J.J. Fong, I. Das, and T. Papenfuss. 2006. The complete mitochondrial genome of an agamid lizards from the Afro-Asian subfamily Agaminae and the phylogenetic position of *Bufoniceps* and *Xenagama*. *Molecular Phylogenetics and Evolution* 39:881–886.

Macey, J.R., J.A. Schulte II, A. Larson, N.B. Ananjeva, Y. Wang, R. Pethiyagoda, N. Rastegar-Pouyani, and T.J. Papenfuss. 2000b. Evaluating trans-Tethys migration: an example using acrodont lizard phylogenetics. *Systematic Biology* 49(2):233–256.

Mackay, J.Y. 1886. The arterial system of the chamaeleon (*Chamaeleo vulgaris*). *Proceedings of the Philosophical Society of Glasgow* 17:353–365.

Macleod, N., P.F. Rawson, P.L. Forey, F.T. Banner, M.K. Boudagher-Fadel, P.R. Bown, J.A. Burnett, P. Chambers, S. Culver, S.E. Evans, C. Jeffery, M.A. Kaminski, A.R. Lord, A.C. Milner, A.R. Milner, N. Morris, E. Owen, B.R. Rosen, A.B. Smith, P.D. Taylor, E. Urquhart, and Y.R. Young. 1997. The Cretaceous-Tertiary biotic transition. *Journal of the Geological Society* 154:265–292.

Malan, M.E. 1945. Contributions to the comparative anatomy of the nasal capsule and the organ of Jacobson of the Lacertilia. *Annale van die Universiteit van Stellenbosch* 24:69–138.

Maley, J. 1996. The African rain forest-main characteristics of changes in vegetation and climate from the Upper Cretaceous to the Quaternary. *Proceedings of the Royal Society of Edinburgh Section B: Biology* 104:31–73.

Mariaux, J., N. Lutzmann, and J. Stipala. 2008. The two-horned chameleons of East Africa. *Zoological Journal of the Linnean Society*152:367–391.

Mariaux, J., and C.R. Tilbury. 2006. The pygmy chameleons of the Eastern Arc Range (Tanzania): evolutionary relationships and the description of three new species of *Rhampholeon* (Sauria: Chamaeleonidae). *Herpetological Journal* 16(3):315–331.

Markwick P.J., and P.J. Valdes. 2004. Palaeo-digital elevation models for use as boundary conditions in coupled ocean-atmosphere GCM experiments: a Maastrichtian (Late Cretaceous) example. *Palaeogeography, Palaeoclimatology, Palaeoecology* 213:37–63.

Marsh, O. 1872. Preliminary description of new Tertiary reptiles. Parts I and II. *American Journal of Science* 4:298–309.

Martin, J. 1992. *Masters of Disguise: A Natural History of Chameleons*. New York: Facts on File.

Massot, M., J. Clobert, and R. Ferriere. 2008. Climate warming, dispersal inhibition and extinction risk. *Global Change Biology* 14:461–469.

Masterson, A.N.B. 1994. Do flap-necked chameleons eat birds? *Honeyguide* 40:186.

Masterson, A.N.B. 1999. Another chameleon basher: the crested barbet. *Honeyguide* 45:142.

Mates, J.W.B. 1978. Eye movements of African chameleons: spontaneous saccade timing. *Science* 199:1087–1088.

Matthee, C.A., C.R. Tilbury, and T. Townsend. 2004. A phylogenetic review of the African leaf chameleons: genus *Rhampholeon* (Chamaeleonidae): the role of vicariance and climate change in speciation. *Proceedings of the Royal Society B* 271:1967–1975.

Matthey, R. 1957. Cytologie comparée et taxonomie des Chamaeleontidae (Reptilia - Lacertilia). *Revue suisse de zoologie* 64:709–732.

Matthey, R., and J.M. van Brink. 1956. Note preliminaire sur la cytologie chromosomique comparée des Caméléons. *Revue suisse de zoologie* 63:241–246.

Matthey, R., and J.M. van Brink. 1960. Nouvelle contribution à la cytology comparée des Chamaeleontidae (Reptilia-Lacertilia). *Bulletin de la Société vaudoise des sciences naturelles* 67:241–246.

Mattingly, W.B., and B.C. Jayne. 2004. Resource use in arboreal habitats: structure affects locomotion of four ecomorphs of *Anolis* lizards. *Ecology* 85 (4):1111–1124.

Maul, L.C., K.T. Smith, R. Barkai, A. Barash, P. Karkanas, R. Shahack-Gross, and A. Gopher. 2011. Microfaunal remains at Middle Pleistocene Qesem Cave, Israel: Preliminary results on small vertebrates, environment and biostratigraphy. *Journal of Human Evolution* 60(4):464–480.

Mayer, A.F. 1835. Analecten für vergleichende Anatomie. Bonn, Germany: Eduard Weber [in German].

McCarthy, T., and B. Rubidge. 2005. The story of earth and life: a southern African perspective on a 4.6-billion-year journey. Cape Town, South Africa: Struik Publishers.

McKee, J.K., P.W. Sciulli, C.D. Fooce, and T.A. Waite. 2004. Forecasting global biodiversity threats associated with human population growth. *Biological Conservation* 115:161–164.

Measey, J. 2008. Das Taita-Zweihornchamäleon - auf der Suche nach Chamäleons in ihrem natürlichen Habitat. *Chamaeleo Mitteilungsblatt* 37:17–24.

Measey, G.J., K. Hopkins, and K.A. Tolley. 2009. Morphology, ornaments and performance in two chameleon ecomorphs: is the casque bigger than the bite? *Zoology* 112:217–226.

Measey, G.J., A.D. Rebelo, A. Herrel, B. Vanhooydonck, and K.A. Tolley. 2011.Diet, morphology and performance in two chameleon morphs: do harder bites equate with harder prey? *Journal of Zoology* 285(4):247–255.

Measey, G.J., and K.A. Tolley. 2011. Sequential fragmentation of Pleistocene forests in an East Africa biodiversity hotspot: chameleons as a model to track forest history. *PLoS ONE* 6:e26606.

Meiri, S. 2008. Evolution and ecology of lizard body sizes. *Global Ecology and Biogeography* 17:724–734.

Meldrum, D.J. 1998. Tail-assisted hind limb suspension as a transitional behavior in the evolution of the platyrrhine prehensile tail, pp 145–156. In E. Strasser, J. Fleagle, A. Rosenberger and H. McHenry, Eds., *Primate Locomotion: Recent Advances*. New York: Plenum Press.

Melville, J., E.G. Ritchie, S.N.J. Chapple, R.E. Glor, and J.A. Schulte II. 2011. Evolutionary origins and diversification of dragon lizards in Australia's tropical savannas. *Molecular Phylogenetics and Evolution* 58(2):257–270.

Melville, J., and R. Swain. 2000. Evolutionary relationships between morphology, performance and habitat openness in the lizard genus *Niveoscincus* (Scincidae: Lygosominae). *Biological Journal of the Linnean Society* 70:667–683.

Menegon, M., C. Bracebridge, N. Owen, and S.P. Loader. 2011. Herpetofauna of montane areas of Tanzania. 4. Amphibians and reptiles of Mahenge Mountains, with comments on biogeography, diversity, and conservation. *Fieldiana Life and Earth Sciences* 4:103–111

Menegon, M., N. Doggart, and N. Owen. 2008. The Nguru Mountains of Tanzania, an outstanding hotspot of herpetofaunal diversity. *Acta Herpetologica* 3:107–127.

Menegon, M. and T. Davenport. 2008. The amphibian fauna of the Eastern Arc Mountains of Kenya and Tanzania. Pp. 63 in Stuart, SN., Hoffmann, M., Chanson, J.S., Cox, N.A., Berridge, R.J., Ramani P., and B.E. Young, Eds., *Threatened Amphibians of the World*. Lynx Edicions: Barcelona, Spain.

Menegon, M., and S. Salvidio. 2005. Amphibian and reptile diversity in the southern Udzungwa Scarp Forest Reserve, South-Eastern Tanzania, pp. 205–212. In B.A. Huber, B.J. Sinclair and K.H. Lampe Eds., *African Biodiversity: Molecules, Organisms, Ecosystems*. Proceedings of the 5th International Symposium on Tropical Biodiversity, Museum Koenig, Bonn. New York: Springer.

Menegon, M., K.A. Tolley, T. Jones, F. Rovero, A.R. Marshall, and C.R. Tilbury. 2009. A new species of chameleon (Sauria: Chamaeleonidae: *Kinyongia*) from the Magombera forest and Udzungwa Mountains National Park, Tanzania. *African Journal of Herpetology* 58(2): 59–70.

Mertens, R. 1966. Chamaeleonidae. *Das Tierreich, Berlin* 83:1–37.

Metcalf, J., N. Bayly, M. Bisoa, and J. Rabearivony. 2005. Edge effect from paths on two chameleon species in Madagascar. *African Journal of Herpetology* 54:99–102.

Metcalfe, I. 1996a. Pre-Cretaceous evolution of SE Asian terrones. Pp. 97–122 in R. Hall, and D.J. Blundell, Eds., *Tectonic Evolution of Southeast Asia*. London: Geological Society. Special Publication 106.

Metcalfe, I. 1996b. Gondwanaland dispersion, Asian accretion and evolution of Eastern Tethys. *Australian Journal of Earth Sciences* 43:605–623.

Methuen, P.A., and J. Hewitt. 1914. A contribution to our knowledge of the anatomy of chamaeleons. *Transactions of the Royal Society of South Africa* 4(2):89–104.

Meyers, J.J., A. Herrel, and K.C. Nishikawa. 2002. Comparative study of the innervation patterns of the hyobranchial musculature in three iguanian lizards: *Sceloporus undulates, Pseudotrapelus sinaitus,* and *Chamaeleo jacksonii*. *Anatomical Record* 267(2):177–189.

Meyers, J.J., and K.C. Nishikawa. 2000. Comparative study of tongue protrusion in the three iguanian lizards, *Sceloporus undulates, Pseudotrapelus sinaitus* and *Chamaeleo jacksonii*. *Journal of Experimental Biology* 203 (18):2833–2849.

Meyers, R.A., and B.M. Clarke. 1998. How do flap-necked chameleons move their flaps? *Copeia* 1998(3):759–761.

Miehe, S., and G. Miehe. 1994. *Ericaceous forests and heathlands in the Bale Mountains of South Ethiopia:. Ecology and Man's Impact*. Reinbek, Germany: Warnke.

Mittermeier, R.A., P. Robles Gil, M. Hoffman, J. Pilgrim, T. Brooks, C. Goettsch Mittermeier, J. Lamoreux, and G.A.B. da Fonseca. 2004. *Hotspots Revisited*. Mexico City: CEMEX, Agrupación Sierra Madre, S.C.

Mivart, S.G. 1870. On the myology of *Chamaeleon parsonii*. *Proceedings of the Scientific Meetings of the Zoological Society of London* 57:850–890.

Monadjem, A., M.C. Schoeman, A. Reside, D.V. Pio, S. Stoffberg, J. Bayliss, F.P.D. Cotterill, M. Curran, M. Kopp, and P.J. Taylor. 2010. A recent inventory of the bats of Mozambique with documentation of seven new species for the country. *Acta Chiropterologica* 12:371–391.

Montuelle, S., G. Daghfous, and V. Bels. 2008. Effect of locomotor approach on feeding kinematics in the green anole (*Anolis carolinensis*). *Journal of Experimental Zoology* 309A(9):563–567.

Moody, S. 1980. The phylogenetic relationships of taxa within the lizard family Agamidae. Ph.D. thesis. University of Michigan.

Moody, S., and Z. Roček. 1980. *Chamaeleo caroliquarti* (Chamaeleonidae, Sauria), a new species from the Lower Miocene of central Europe. *Věstník Ústředního ústavu geologického* 55:85–92.

Mooi, R.D., and A.C. Gill. 2010. Phylogenies without synapomorphies—a crisis in fish systematics: time to show some character. *Zootaxa* 2450:26–40

Morrison, R.L., W.C. Sherbrooke, and S.K. Frostmason. 1996. Temperature-sensitive, physiologically active iridophores in the lizard *Urosaurus ornatus*: an ultrastructural analysis of color change. *Copeia* 1996:804–812.

Moreno-Rueda, G., J.M. Pleguezuelos, M. Pizarro, and A. Montori. 2011. Northward shifts of the distributions of Spanish reptiles in association with climate change. *Conservation Biology* 26:278–283.

Mörs, T. 2002. Biostratigraphy and paleoecology of continental Tertiary vertebrate faunas in the Lower Rhine Embayment (NW-Germany). *Netherlands Journal of Geosciences/Geologie en Mijnbouw* 81:177–183.

Mörs, T., F. von der Hocht, and B. Wutzler, 2000. Die erste Wirbeltierfauna aus der miozänen Braunkohle der Niederrheinischen Bucht (Ville-Schichten,Tagebau Hambach). *Paläontologische Zeitschrift* 74:145–170 [in German].

Müller, R., and T. Hildenhagen. 2009. Untersuchungen zu Subdigital- und Subcaudalstrukturen bei Chamäleons (Sauria: Chamaelaeonidae). *Sauria* 31(3):41–54 [in German with English summary].

Müller, U.K., and S. Kranenbarg. 2004. Power at the tip of the tongue. *Science* 304 (5668):217–218.

Mutungi, G. 1992. Slow locomotion in chameleons: histochemical and ultrastructural characteristics of muscle fibers isolated from iliofibularis muscle of Jackson's chameleon (*Chamaeleo jacksonii*). *Journal of Experimental Zoology* 263:1–7.

Myers, N., R.A. Mittermeier, C.G. Mittermeier, G.A.B. Da Fonseca, and J. Kent. 2000. Biodiversity hotspots for conservation priorities. *Nature* 403:853–858.

Nagy, Z.T., G. Sonet, F. Glaw, and M. Vences. 2012. First large-scale DNA barcoding assessment of reptiles in the biodiversity hotspot of Madagascar, based on newly designed COI primers. *PloS ONE* 7:e34506.

Nečas, P. 2004. *Chameleons: Nature's Hidden Jewels,* 2nd ed. Frankfurt am Main, Germany: Chimaira.

Nečas, P. 2009. Ein neues Chamäleon der Gattung *Kinyongia* Tilbury Tolley & Branch 2006 aus den Poroto-Bergen, Süd-Tansania (Reptilia: Sauria: Chamaeleonidae). *Sauria* 31(2):41–48.

Nečas, P., and W. Schmidt. 2004. *Stump-tailed Chameleons: Miniature Dragons of the Rainforest. The Genera Brookesia and Rhampholeon*. Frankfurt am Main, Germany: Chimaira Buchhandelsgesellschaft mbH.

Nečas, P., R. Sindaco, L. Koreny, J. Kopecna, P.K. Malonza, and D. Modry. 2009. *Kinyongia asheorum* sp. n., a new montane chameleon from the Nyiro Range, northern Kenya (Squamata: Chamaeleonidae). *Zootaxa* 2028:41–50.

Nechaeva, M.V., I.G. Makarenko, E.B. Tsitrin, and N.P. Zhdanova. 2005. Physiological and morphological characteristics of the rhythmic contractions of the amnion in veiled chameleon (*Chameleo calyptratus*) embryogenesis. *Comparative Biochemistry and Physiology A—Physiology* 140: 19–28.

Nelson, G., and P.Y. Ladiges. 2009. Biogeography and the molecular dating game: a futile revival of phentics? *Bulletin de la Societe Geologique de France* 180(1):39–43.

Nessov, L.A. 1988. Late mesozoic amphibians and lizards of Soviet Middle Asia. *Acta Zoologica Cracoviensia* 31:475–486.

Nonnotte, P., H. Guillou, B. Le Gall, M. Benoit, J. Cotten, and S. Scaillet. 2008. New K-Ar age determinations of Kilimanjaro volcano in the North Tanzanian diverging rift, East Africa. *Journal of Volcanology and Geothermal Research* 173:99–112.

Norris, K.S., and W.R. Dawson. 1964. Observations on the water economy and electrolyte excretion of chuckwallas (Lacertilia, *Sauromalus*). *Copeia* 1964:638–646.

Northcutt, R.G. 1978. Forebrain and midbrain organization in lizards and its phylogenetic significance, pp. 11–64. In N. Greenberg and P.D. MacLean, Eds., *Behavior and Neurology of Lizards*. Rockville, MD: National Institute of Mental Health.

Nussbaum, R.A., C.J. Raxworthy, A.P. Raselimanana, and J.-B. Ramanamanjato. 1999. Amphibians and reptiles of the Réserve Naturelle Intégrale d'Andohahela, Madagascar, pp. 155–173. In S.M. Goodman, Ed., *A Floral and Faunal Inventory of the Réserve Naturelle Intégrale d'Andohahela, Madagascar: With Reference to Elevational Variation*. Fieldiana Zoology, new series, 94. Chicago: Field Museum of Natural History.

Ogg, J.G., G. Ogg, and F.M. Gradstein. 2008. *The concise geologic time scale*. Cambridge, United Kingdom: Cambridge University Press.

Ogilvie, P.W. 1966. An anatomical and behavioral investigation of a previously undescribed pouch found in certain species of the genus *Chamaeleo*. PhD thesis, University of Oklahoma.

Okajima, Y., and Y. Kumazawa. 2010. Mitochondrial genomes of acrodont lizards: timing of gene rearrangements and phylogenetic and biogeographic implications. *BMC Evolutionary Biology* 10(141):1–15.

Ord, T.J., and J.A. Stamps. 2009. Species identity cues in animal communication. *American Naturalist* 174:585–593.

Osorio, D., A. Miklosi, and Z. Gonda. 1999. Visual ecology and perception of coloration patterns by domestic chicks. *Evolutionary Ecology* 13:673–689.

Ott, M. 2001. Chameleons have independent eye movements but synchronise both eyes during saccadic prey tracking. *Experimental Brain Research* 139:173–179.

Ott, M., and F. Schaeffel. 1995. A negatively powered lens in the chameleon. *Nature* 373:692–694.

Ott, M., F. Schaeffel, and W. Kirmse. 1998. Binocular vision and accommodation in prey-catching chameleons. *Journal of Comparative Physiology A—Sensory Neural and Behavioural Physiology* 182:319–330.

Parcher, S.R. 1974. Observations on the Natural Histories of Six Malagasy Chamaeleontidae [sic]. *Zeitschrift für Tierzuchtung und Zuchtungsbiologie* 34:500–523.

Parker, H.W. 1942. The lizards of British Somaliland. *Bulletin of the Museum of Comparative Zoology at Harvard College* 91:1–101.

Parker, W.K. 1881. On the structure of the skull in the chameleons. *Transactions of the Zoological Society of London* 11:77–105.

Parsons, T.S. 1970. The nose and Jacobson's organ, pp. 99–191. In C. Gans and T.S. Parsons, Eds. *Biology of the Reptilia. Volume 2. Morphology B*. New York: Academic Press.

Parsons, T.S., and J.E. Cameron. 1977. Internal relief of the digestive tract, pp. 159–223. In C. Gans and T.S. Parsons, Eds., *Biology of the Reptilia. Volume 6. Morphology E*. New York: Academic Press.

Patnaik, R., and H.H. Schleich. 1998. Fossil micro-reptiles from Pliocene Siwalik sediments of India. *Veroffentlichungen aus dem Fuhlrott Museum* 4:295–300.

Patrick, D.A., P. Shirk, J.R. Vonesh, E.B. Harper, and K.M. Howell. 2011. Abundance and roosting ecology of chameleons in the East Usambara Mountains of Tanzania and the potential effects of harvesting. *Herpetological Conservation and Biology* 6:422–431.

Paulo, O.S., I. Pinto, M.W. Bruford,W.C. Jordan, and R.A. Nichols. 2002. The double origin of Iberian peninsular chameleons. *Biological Journal of the Linnean Society* 75:1–7.

Paxton, J.R. 1991. Interaction between laughing doves and chameleon. *Honeyguide* 37:180–181.

Peaker, M., and J.L. Linzell. 1975. *Salt Glands in Birds and Reptiles*. Cambridge, United Kingdom: Cambridge University Press.

Pearson, R.G., and C.J. Raxworthy. 2009. The evolution of local endemism in Madagascar: watershed versus climatic gradient hypotheses evaluated by null biogeographic models. *Evolution* 63:959–967.

Perry, S.F. 1998. Lungs: Comparative Anatomy, Functional Morphology, and Evolution, pp. 1–92. In C. Gans and A.S. Gaunt, Eds., *Biology of the Reptilia. Volume 19. Morphology G*. Ithaca, NY: Society for the Study of Amphibians and Reptiles.

Peterson, J.A. 1973. Adaptation for arboreal locomotion in the shoulder region of lizards. PhD thesis, University of Chicago.

Peterson, J.A. 1984. The locomotion of *Chamaeleo* (Reptilia: Sauria) with particular reference to the forelimb. *Journal of Zoology, London* 202:1–42.

Pettigrew, J.D., S.P. Collin, and M. Ott. 1999. Convergence of specialised behaviour, eye movements and visual optics in the sandlance (Teleostei) and the chameleon (Reptilia). *Current Biology* 9(8):421–424.

Pianka, E.R. 1986. *Ecology and natural history of desert lizards: analyses of the ecological niche and community structure*. Princeton, NJ: Princeton University Press.

Pianka, E.R., and L.J. Vitt. 2003. *Lizards: Windows to the Evolution of Diversity*. Berkeley: University of California Press.

Pickford, M. 1986. Sediment and fossil preservation in the Nyanza Rift system of Kenya. *Geological Society Special Publication* 25:345–362.

Pickford, M. 2001. Africa's smallest ruminant: a new tragulid from the Miocene of Kenya and the biostratigraphy of East African Tragulidae. *Geobios* 34(4):437–447.

Pickford, M., Y. Sawada, R. Tayama, Y. Matsuda, T. Itaya, H. Hyodo, and B. Senut. 2006. Refinement of the age of the Middle Miocene Fort Ternan Beds, Western Kenya, and its implications for Old World biochronology. *Comptes Rendus Geoscience* 338:545–555.

Pitman, C.R.S. 1958. Snake and lizard predation of birds. *Bulletin of the British Ornithology Club* 78:120–124.

Pleguezuelos, J.M., J.C. Poveda, R. Monterrubio, and D. Ontiveros. 1999. Feeding habits of the common chameleon, *Chamaeleo chamaeleon* in the southeastern Iberian Peninsula. *Israel Journal of Zoology* 45:267–276.

Plumptre, A.J., T.R.B. Davenport, M. Behangana, R. Kityo, G. Eilu, P. Ssegawa, C. Ewango, D. Meirte, C. Kahindo, M. Herremans, J.K. Peterhans, J.D. Pilgrim, M. Wilson, M. Languy, and D. Moyer. 2007. The biodiversity of the Albertine Rift. *Biological Conservation* 134:178–194.

Poglayen-Neuwall, I. 1954. Die Kiefermuskulatur der Eidechsen und ihre Innervation. *Zeitschrift für Wissenschaftliche Zoologie* 158:79–132 [in German].

Pook, C., and C. Wild. 1997. The phylogeny of the *Chamaeleo (Trioceros) cristatus* species group from Cameroon inferred from direct sequencing of the mitochondrial 12S ribosomal RNA gene: Evolutionary and paleobiogeographic implications, pp. 297–306. In W. Böhme, W. Bischoff and T. Ziegler, Eds., *Herpetologia Bonnensis*. Bonn, Germany: Societas Europaea Herpetologica.

Potgieter, D. 2012. *Investigating the presence of ecomorphological forms in Bradypodion damaranum using molecular and morphometric techniques*. M.Sc. thesis. Stellenbosch University, Stellenbosch.

Pounds, J.A., M.R. Bustamante, L.A. Coloma, J.A. Consuegra, M.P. Fogden, P.N. Foster, E. La Marca, et al. 2006. Widespread amphibian extinctions from epidemic disease driven by global warming. *Nature* 439:161–167.

Pounds, J.A., M.L.P. Fogden, and J.H. Campbell. 1999. Biological response to climate change on a tropical mountain. *Nature* 398:611–615.

Poynton, J., and R. Boycott. 1996. Species turnover between Afromontane and eastern African lowland faunas: patterns shown by amphibians. *Journal of Biogeography* 23:669–680.

Poynton, J.C., S.P. Loader, E. Sherratt, and B.T. Clarke. 2006. Amphibian diversity in East African biodiversity hotspots: altitudinal and latitudinal patterns. *Biodiversity and Conservation* 16:1103–1118.

Prasad, G.V.R., and S. Bajpai. 2008. Agamid lizards from the Early Eocene of Western India: Oldest Cenozoic lizards from South Asia. *Palaeontologia Electronica* 11(1):1–19.

Prasad, J. 1954. The temporal region in the skull of *Chamaeleon zeylanicus* Laurenti. *Current Science* 23:235–236.

Prieto, J., M. Böhme, H. Maurer, K. Heissig, and H. Abdul Aziz. 2009. Biostratigraphy and sedimentology of the Fluviatile Untere Serie (Early and Middle Miocene) in the central part of the North Alpine Foreland Basin: implications for palaeonvironment and climate. *International Journal of Earth Sciences (Geologische Rundschau)* 98:1767–1791.

Prothero, D., and R. Estes. 1980. Late Jurassic lizards from Como Bluff, Wyoming and their palaeobiogeographic significance. *Nature* 286:484–486.

Quay, W.B. 1979. The parietal eye-pineal complex, pp. 245–406. In C. Gans, R.G. Northcutt and P. Ulinski, Eds., *Biology of the Reptilia. Volume 9. Neurology A*. New York: Academic Press.

Rabearivony, J. 1999. Conservation and status of assessment of *Brookesia,* the dwarf chameleons of Madagascar. M.Sc. thesis, University of Kent, United Kingdom.

Rabearivony, J. 2012. Etude bio-écologique et conservation des caméléons dans les habitats écotoniques des rivières malgaches. Thèse de Doctorat. Facultés des Sciences, Université d'Antananarivo.

Rabearivony, J., L.D. Brady, R.K. Jenkins, and O.R. Ravoahangimalala. 2007. Habitat use and abundance of a low-altitude chameleon assemblage in eastern Madagascar. *Herpetological Journal* 17:247–254.

Rage, J.C. 1972. Les amphibiens et les reptiles du du Würmien II de la grotte de l'Hortus. *Études Quaternaires* 1:297–298 [in French].

Rage, J.C. 1987. Lower vertebrates from the early-Middle Eocene Kuldana Formation of Kohat (Pakistan): Squamata. *Contributions from the Museum of Paleontology University of Michigan* 27:187–193.

Rage, J.C., and M. Augé. 1993. Squamates from the Cainozoic of the western part of Europe: a review. *Revue de Paléobiologie* special volume 7:199–216.

Raholdina, A.M.F. 2012. Etude écologique et analyse structural de la population de *Furcifer campani* (Grandidier, 1872) dans le massif de l'Ankaratra. Mémoire de DEA, Facultés des Sciences, Université d'Antananarivo.

Rana, R.S. 2005. Lizard fauna from the Intertrappean (Late Cretaceous-Early Palaeocene) beds of Peninsular India. *Gondwana Geological Magazine Nagpur* 8:123–132.

Randrianantoandro, J.C., R.R. Andriatsimanarilafy, H. Rakotovololonalimanana, E.F. Hantalalaina, D. Rakotondravony, O.R. Ramilijaona, J. Ratsimbazafy, G.F. Razafindrakoto, and R.K.B. Jenkins. 2009. Population assessments of chameleons from two montane sites in Madagascar. *Herpetological Conservation and Biology* 5:23–31.

Randrianantoandro, J.C., R. Randrianavelona, R.R. Andriatsimanarilafy, E.F. Hantalalaina, D. Rakotondravony, and R.K.B. Jenkins. 2007a. Roost site characteristics of sympatric dwarf chameleons (genus *Brookesia*) from western Madagascar. *Amphibia-Reptilia* 28:577–581.

Randrianantoandro, J.C., R. Randrianavelona, R.R. Andriatsimanarilafy, E.F. Hantalalaina, D. Rakotondravony, M. Randrianasolo, H.L. Ravelomanantsoa, and R.K.B. Jenkins. 2007b. Identifying important areas fro the conservation of dwarf chameleons (*Brookesia* spp.) in Tsingy de Bemaraha National Park, western Madagascar. *Oryx* 42:578–583.

Randrianantoandro, J.C., B. Razafimahatratra, M. Soazandry, J. Ratsimbazafy, and R.K.B. Jenkins. 2010. Habitat use by chameleons in a deciduous forest in western Madagascar. *Amphibia-Reptilia* 31:27–35.

Raselimanana, A.P. 2008. Herpétofaune des forêts sèches malgaches. *Malagasy Nature* 1:46–75.

Raselimanana, A.P., and D. Rakotomalala. 2003. Chamaeleonidae, chamaeleons, pp. 960–969. In S.M. Goodman and J.P. Benstead, Eds., *The Natural History of Madagascar*. Chicago: University of Chicago Press.

Raselimanana, A. P., C.J. Raxworthy, and R.A. Nussbaum. 2000. Herpetofaunal species diversity and elevational distribution within the Parc National de Marojejy, Madagascar, pp. 157–174. In S. M. Goodman, *A Floral and Faunal Inventory of the Parc National de Marojejy, Madagascar: With Reference to Elevational Variation*. Fieldiana: Zoology, new series, 97. Chicago: Field Museum of Natural History.

Rathke, H. 1857. Untersuchungen über die Aortenwurzeln und die von ihnen ausgehenden Arterien der Saurier. *Denkschriften/Akademie der Wissenschaften in Wien, Mathematisch-Naturwissenschaftliche Klasse* 13:51–142 [in German].

Raw, L.R.G. 1976. A survey of the dwarf chameleons of Natal, South Africa, with descriptions of three new species (Sauria: Chamaeleonidae). *Durban Museum Novitates* 11(7):139–161.

Raxworthy, C.J. 1988. Reptiles, rainforest and conservation in Madagascar. *Biological Conservation* 43:181–211.

Raxworthy, C.J. 1991. Field observations on some dwarf chameleons (*Brookesia* spp.) from rainforest areas of Madagascar, with the description of a new species. *Journal of Zoology, London* 224:11–25.

Raxworthy, C.J., M.R.J. Forstner, and R.A. Nussbaum. 2002. Chameleon radiation by oceanic dispersal. *Nature* 415:784–787.

Raxworthy, C.J., and R.A. Nussbaum. 1995. Systematics, speciation and biogeography of the dwarf chameleons (*Brookesia*: Reptilia, Squamata, Chamaeleonitidae) of northern Madagascar. *Journal of Zoology, London* 235:525–558.

Raxworthy, C.J., and R.A. Nussbaum. 1996. Montane amphibian and reptile communities in Madagascar. *Conservation Biology* 10:750–756.

Raxworthy, C.J., and R.A. Nussbaum. 2006. Six new species of occipital-lobed *Calumma* chameleons (Squamata: Chamaeleonidae) from montane regions of Madagascar, with a new description and revision of *Calumma brevicorne*. *Copeia* 2006(4):711–734.

Raxworthy, C. J., R.G. Pearson, N. Rabibisoa, A.M. Rakotondrazafy, J.-B. Ramanamanjato, A.P. Raselimanana, S. Wu, R.A. Nussbaum, and D.A. Stone. 2008. Extinction vulnerability of tropical montane endemism from warming and upslope displacement: a preliminary appraisal for the highest massif in Madagascar. *Global Change Biology* 14:1703–1720.

Razafimahatratra, B., A. Mori, and M. Hasegawa. 2008. Sleeping site pattern and sleeping behavior of *Brookesia decaryi* (Chamaeleonidae) in Ampijoroa dry forest, northwestern Madagascar. *Current Herpetology* 27:93–99.

Reaney, L.T., S. Yee, J.B. Losos, and M.J. Whiting. 2012. Ecology of the flap-necked chameleon *Chamaeleo dilepis* in southern Africa. *Breviora* 532:1–18.

Regal, P.J. 1978. Behavioral differences between reptiles and mammals: an analysis of activity and mental capabilities, pp. 183–202. In N. Greenberg and P.D. Maclean, Eds., *Behavior and neurobiology of lizards*. Washington, DC: Department of Health, Education and Welfare.

Reid, J.C. 1986. A list with notes of Lizards of the Calabar area of southern Nigeria, pp 699–704. In Z. Roček, Ed., *Studies in Herpetology*. Prague, Czech Republic: Charles University.

Reilly, S.M. 1982. Ecological notes on *Chamaeleo schubotzi* from Mount Kenya. *Journal of the Herpetological Association of Africa* 18:28–30.

Reisinger, W.J., D.M. Stuart-Fox, and B.F.N. Erasmus. 2006. Habitat associations and conservation status of an endemic forest dwarf chameleon (*Bradypodion* sp.) from South Africa. *Oryx* 40:183–188.

Rewcastle, S.C. 1981. Stance and gait in tetrapods: an evolutionary scenario, pp 239–267. In M.H. Day, Ed., *Vertebrate Locomotion*. London: Academic Press.

Rewcastle, S.C. 1983. Fundamental adaptations in the lacertilian hind limb: a partial analysis of the sprawling limb posture and gait. *Copeia* 1983 (2):476–487.

Reynoso, V.-H., 1998. *Huehuecuetzpalli mixtecus* gen. et sp. nov: a basal squamate (Reptilia) from the Early Cretaceous of Tepexi de Rodríguez, Central México. *Philosophical Transactions of the Royal Society of London B* 353:477–500.

Ribbing, L. 1938. Die Muskeln und Nerven der Extremitaten, pp. 543–682. In L. Bolk, E. Goppert, E. Kallius and W. Lubosch, Eds., *Handbuch der vergleichenden Anatomie der Wirbeltiere*. Berlin: Urban and Schwarzenberg [in German].

Rice, M.J. 1973. Supercontracting striated muscle in a vertebrate. *Nature* 243:238–240.

Richter, B., and M. Fuller. 1996. Palaeomagnetism of the Sibumasu and Indochina blocks: Implications for the extrusion tectonic model, pp. 203–224. In R. Hall, and D. Blundell, Eds., *Tectonic Evolution of Southeast Asia*. London: Geological Society Special Publication 106.

Rieppel, O. 1981. The skull and jaw adductor musculature in chameleons. *Revue Suisse de Zoologie* 88(2):433–445.

Rieppel, O. 1987. The phylogenetic relationships within the Chamaeleonidae, with comments on some aspects of cladistics analysis. *Zoological Journal of the Linnean Society* 89(1):41–62.

Rieppel, O. 1993. Studies on skeleton formation in reptiles. II. *Chamaeleo hoehnelii* (Squamata: Chamaeleoninae), with comments on the homology of carpal and tarsal bones. *Herpetologica* 49(1):66–78.

Rieppel, O., and C. Crumly. 1997. Paedomorphosis and skull structure in Malagasy chamaeleons (Reptilia: Chamaeleoninae). *Journal of Zoology, London* 243(2):351–380.

Rieppel, O., A. Walker, and I. Odhiambo. 1992. A preliminary report on a fossil chamaeleonine (Reptilia: Chamaeleoninae) skull from the Miocene of Kenya. *Journal of Herpetology* 26(1):77–80.

Rigby, B.J., N. Hirai, J.D. Spikes, and H. Eyring. 1959. The mechanical properties of rat tail tendon. *Journal of General Physiology* 43:265–283.

Roček, Z. 1984. Lizards (Reptilia: Sauria) from the Lower Miocene locality Dolnice (Bohemia, Czechoslovakia). *Rozpravy Československé Akademie Věd* 94(1):1–69.

Rocha, S., M.A. Carretero, and D.J. Harris. 2005. Mitochondrial DNA sequence data suggests two independent colonizations of the Comoros archipelago by chameleons of the genus *Furcifer*. *Belgian Journal of Zoology* 135(1):39–42.

Rodrigues, A.S.L., J.D. Pilgrim, J.F. Lamoreux, M. Hoffmann, and T.M. Brooks. 2006. The value of the IUCN Red List for conservation. *Trends in Ecology and Evolution* 21:71–76.

Romanoff, A.L. 1960. *The avian embryo: structural and functional development*. New York: Macmillan.

Rome, L.C. 1990. Influence of temperature on muscle recruitment and muscle function in vivo. *American Journal of Physiology* 259(2 Pt 2):R210-R222.

Romer, A.S. 1956. Osteology of the Reptiles. Chicago: University of Chicago Press.

Ross, H.H. 1964. Book Review: Principles of numerical taxonomy. *Systematic Zoology* 13:106–108.

Russell, A.P., and A. M. Bauer. 2008. The appendicular locomotor apparatus of *Sphenodon* and normal-limbed squamates, pp. 1–466. In C. Gans, A. S. Gaunt and K. Adler, Eds., *Biology of the Reptilia. Volume 21. Morphology I*. Ithaca, NY: Society for the Study of Amphibians and Reptiles.

Russell, A.P., and V. Bels. 2001. Biomechanics and kinematics of limb-based locomotion in lizards: review, synthesis and prospectus. *Comparative Biochemistry and Physiology A* 131:89–112.

Russell, A.P., and T.E. Higham. 2009. A new angle on clinging in geckos: incline, not substrate, triggers the deployment of the adhesive system. *Proceedings of the Royal Society B* 276(1673):3705–3709.

Russell, A.P., and M.K. Johnson. 2007. Real-world challenges to, and capabilities of, the gekkotan adhesive system: contrasting the rough and the smooth. *Canadian Journal of Zoology* 85:1228–1238.

Sahni, A. 2010. Indian Cretaceous terrestrial vertebrates: cosmopolitanism and endemism in a geodynamic plate tectonic framework, pp. 91–104. In S. Bandyopadhyay Ed., *New Aspects of Mesozoic Biodiversity*. Lecture Notes in Earth Sciences 132. Berlin: Springer Verlag.

Salzmann, U., and P. Hoelzmann. 2005. The Dahomey Gap: an abrupt climatically induced rain forest fragmentation in West Africa during the late Holocene. *The Holocene* 15(2):190–199.

Sándor, P.S., M.A. Frens, and V. Henn. 2001. Chameleon eye position obeys Listing's law. *Vision Research* 41:2245–2251.

Sathe, A.M. 1959. Trunk musculature of *Chamaeleon vulgaris* (Reptilia). *First All-India Congress of Zoology, Jabalpur. Abstracts of Papers* October 24–29, 1959:16.

Schaefer, N. 1971. A few thoughts concerning the life span of chameleons. *Journal of the Herpetological Association of Africa* 8:21–24.

Schleich, H.H. 1983. Die mittelmiozäne Fossil-Lagerstätte Sandelzhausen. 13. *Chamaeleo bavaricus* sp. nov., ein neuer Nachweis aus dem Jungtertiär Süddeutchlands. *Mitteilungen der Beyerischen Staatssamlung für Palaeontologie und Historische Geologie* 23:77–81 [in German].

Schleich, H.H. 1984. Neue Reptilienfunde aus dem Tertiär Deutschlands 2. *Chamaeleo pfeili* sp. nov. von der untermiozänen Fossilfundstelle Rauscheröd/Niederbayern (Reptilia, Sauria, Chamaeleonidae). *Mitteilungen der Bayerischen Staatssamlung für Palaeontologie und Historische Geologie* 24:97–103 [in German].

Schleich, H.H. 1994. Neue Reptilfunde aus dem Tertiär Deutschlands. 15. Neue Funde fossiler Chamäleonen aus dem Neogen Süddeutschlands. *Courier Forschunginstitut Senckenberg* 173:175–195 [in German].

Schleich, H.-H., and W. Kästle. 1979. Hautstrukturen als Kletteranpassungen bei *Chamaeleo* und *Cophotis*. *Salamandra* 15(2):95–100 [in German with English summary].

Schleich, H.-H., and W. Kästle. 1985. Skin structures of Sauria extremities—SEM-studies of four families. *Fortschritte der Zoologie* 30:99–101.

Schmidt, W.J. 1909. Beiträge zur Kenntnis der Parietalorgane der Saurien. *Zeitschrift für Wissenschaftliche Zoologie* 92:359–425 [in German].

Schmidt-Nielsen, K. 1963. Osmotic regulation in higher vertebrates. *Harvey Lectures* 58:53–93.

Schulte II, J.A., J. Melville, and A. Larson, 2003. Molecular phylogenetic evidence for ancient divergence of lizard taxa on either side of Wallace's Line. *Proceedings of the Royal Society of London B: Biological Sciences* 270:597–603.

Schulte, J.A., and F. Moreno-Roark. 2010. Live birth among Iguanian lizards predates Pliocene- Pleistocene glaciations. *Biology Letters* 6:216–218.

Schuster, M. 1984. Zum Beutefangverhalten von *Chamaeleo jacksonii* Boulenger, 1896 (Sauria: Chamaeleonidae). *Salamandra* 20 (1):21–31 [in German with English summary].

Schwartz, J.H., and B. Maresca. 2006. Do molecular clocks run at all? A critique of molecular systematics. *Biological Theory* 1(4):357–371.

Schwenk, K. 1983. Functional morphology and evolution of the chameleon tongue tip. *American Zoologist* 23(4):1028.

Schwenk, K. 1985. Occurrence, distribution and functional significance of taste buds in lizards. *Copeia* 1985(1):91–101.

Schwenk, K. 1995. Of tongues and noses—chemoreception in lizards and snakes. *Trends in Ecology and Evolution* 10:7–12.

Schwenk, K. 2000. Feeding in Lepidosaurs. pp. 175–291 in K. Schwenk, Ed., *Feeding: Form, Function, and Evolution in Tetrapod Vertebrates*. Academic Press: San Diego: USA.

Schwenk, K., and D.A. Bell. 1988. A cryptic intermediate in the evolution of chameleon tongue projection. *Experientia* 44:697–700.

Schwenk, K., and G.S. Throckmorton. 1989. Functional and evolutionary morphology of lingual feeding in squamate reptiles: phylogenetics and kinematics. *Journal of Zoology, London* 219:153–175.

Scotese C. R. 2002. The Paleomap Project. Accessed at www.scotese.com on August 15, 2012.

Secord, R., S.L. Wing, and A. Chew. 2008. Stable isotopes in early Eocene mammals as indicators of forest canopy structure and resource partitioning. *Paleobiology* 34:282–300.

Seiffert, J. 1973. Upper Jurassic lizards from central Portugal. *Memóres Serviços Geológicos de Portugal* (Nova Série 22):1–85.

Senn, D.G., and R.G. Northcutt. 1973. The forebrain and midbrain of some squamates and their bearing on the origin of snakes. *Journal of Morphology* 140:135–152.

Seward, D., D. Grujic, and G. Schreurs. 2004. An insight into the breakup of Gondwana: identifying events through low-temperature thermochronology from the basement rocks of Madagascar. *Tectonics* 23:C3007

Sewertzoff, S.A. 1923. Die Entwickelungsgeschichte der Zunge des *Chamaeleo bilineatus*. *Revue Zoologique Russe* 3:263–283 [in Russian with German translation].

Shanklin, W.M. 1930. The central nervous system of *Chameleon vulgaris*. *Acta Zoologica Stockholm* 11:425–490.

Shanklin, W.M. 1933. The comparative neurology of the nucleus opticus tegmenti with special reference to *Chameleon vulgaris*. *Acta Zoologica Stockholm* 14:163–184.

Shine, R. 1985. The evolution of viviparity in reptiles: an ecological analysis, pp. 605–694. In C. Gans and F. Billett, Eds., *Biology of the Reptilia*. Volume 15. New York: Wiley.

Shine, R., and G.P. Brown. 2008. Adapting to the unpredictable: reproductive biology of vertebrates in the Australian wet-dry tropics. *Philosophical Transactions of the Royal Society B* 363:63–373.

Shine, R., P.S. Harlow, W.R. Branch, and J.K. Webb. 1996. Life on the lowest branch: sexual dimorphism, diet, and reproductive biology of an African twig snake, *Thelotornis capensis* (Serpentes, Colubridae). *Copeia* 1996:290–299.

Shine, R., and M.B. Thompson. 2006. Did embryonic responses to incubation conditions drive the evolution of reproductive modes in squamate reptiles? *Herpetological Monographs* 20:159–171.

Siebenrock, F. 1893. Das Skelet von *Brookesia superciliaris* Kuhl. *Sitzungsberichte der Mathematisch-Naturwissenschaftlichen Classe der Kaiserlichen Akademie der Wissenschaften* 102:71–118 [in German].

Siegel, J.M. 2008. Do all animals sleep? *Trends in Neurosciences* 31:208–213.

Sillman, A.J., J.K. Carver, and E.R. Loew. 1999. The photoreceptors and visual pigments in the retina of a boid snake, the ball python (*Python regius*). *Journal of Experimental Biology* 202:1931–1938.

Sillman, A.J., V.I. Govardovskii, P. Rohlich, J.A. Southard, and E.R. Loew. 1997. The photoreceptors and visual pigments of the garter snake (*Thamnophis sirtalis*): a microspectrophotometric, scanning electron microscopic and immunocytochemical study. *Journal of Comparative Physiology A* 181:89–101.

Sillman, A.J., J.L. Johnson, and E.R. Loew. 2001. Retinal photoreceptors and visual pigments in *Boa constrictor imperator*. *Journal of Experimental Zoology* 290:359–365.

Simonetta, A. 1957. Sulla possibilita che esistano relazioni tra meccanismi cinetici del cranio e morfologia dell'orecchio medio. *Monitore Zoologico Italiano* 65:48–55 [in Italian].

Sinervo, B., and J.B. Losos. 1991. Walking the tight rope: arboreal sprint performance among *Sceloporus occidentalis* lizard populations. *Ecology* 72:1225–1233.

Sinervo, B., F. Mendez-de-la-Cruz, D.B. Miles, B. Heulin, E. Bastiaans, M. Villagran-Santa Cruz, R. Lara-Resendiz, N. Martinez-Mendez, M.L Calderon-Espinosa, R.N. Meza-Lazaro,

H. Gadsden, L.J. Avila, M. Morando, I.J. De la Riva, P.V. Sepulveda, C.F.D. Rocha, N. Ibarguengoytia, C.A. Puntriano, M. Massot, V. Lepetz, T.A. Oksanen, D.G. Chapple, A.M. Bauer, W.R. Branch, J. Clobert, and J.W. Sites Jr. 2010. Erosion of lizard diversity by climate change and altered thermal niches. *Science* 328:894–899.

Singh, L.a.K., L.N. Acharjyo, and H.R. Bustard. 1983. Observations of the reproductive biology of the Indian chameleon *Chamaeleo zeylanicus*. *Journal of the Bombay Natural History Society* 81:86–92.

Skinner, J.H. 1959. Ontogeny of the breast-shoulder apparatus of the South African lacertilian, *Microsaura pumila pumila* (Daudin). *Annale van die Uniwersiteit van Stellenbosch* 35(1):5–66.

Slaby, O. 1984. Morphogenesis of the nasal apparatus in a member of the genus *Chamaeleon* L. (Morphogenesis of the nasal capsule, the epithelial nasal tube and the organ of Jacobson in Sauropsida. VIII). *Folia Morphologica* 32(3):225–246.

Slatyer, C., D. Rosauer, and F. Lemckert. 2007. An assessment of endemism and species richness patterns in the Australian Anura. *Journal of Biogeography* 34:583–596.

Smith, K.T. 2009. Eocene lizards of the clade *Geiseltaliellus* from Messel and Geiseltal, Germany, and the early radiation of Iguanidae (Squamata: Iguania). *Bulletin of the Peabody Museum of Natural History* 50(2):219–306.

Smith, K.T., S.F.K. Schaal, S. Wei, and C.-T. Li. 2011. Acrodont iguanians (Squamata) from the Middle Eocene of the Huadian Basin of Jilin Province, China, with a critique of the taxon "*Tinosaurus*." *Vertebrata PalAsiatica* 49(1):69–84.

So, K.-K.J., P.C. Wainwright, and A.F. Bennet. 1992. Kinematics of prey processing in *Chamaeleo jacksonii*: conservation of function with morphological specialization. *Journal of Zoology, London* 226:47–64.

Spawls, S. 2000. The chameleons of Ethiopia: an annotated checklist, key and field notes. *Walia* 21:3–13.

Spawls, S., K. Howell, R. Drewes, and J. Ashe. 2004. A Field Guide to the Reptiles of East Africa. London: A & C Black.

Spickler, J.C., S.C. Sillett, S.B., Marks, and H.H. Welsh. 2006. Evidence of a new niche for a North American salamander: *Aneides vagrans* residing in the canopy of old-growth redwood forest. *Herpetological Conservation and Biology* 1:16–26.

Stamps, J.A. 1977. Social behavior and spacing patterns in lizards, pp. 264–334 in C. Gans and D.W. Tinkle, Eds., *Biology of the Reptilia, Volume 7, Ecology and Behavior A*. New York: Academic Press.

Stefanelli, A. 1941. I centri motori dell'occhio e le loro connessioni nel *Chamaeleon vulgaris*, con riferimenti comparative in altri rettili. *Archivio Italiano di Anatomia e di Embriologia* 45:360–412 [in Italian].

Stevens, M., and S. Merilaita. 2009. Animal camouflage: current issues and new perspectives. *Philosophical Transactions of the Royal Society B* 364:423–427.

Stipala, J., N. Lutzmann, P.K. Malonza, L. Borghesio, P. Wilkinson, B. Godley, and M.R. Evans. 2011. A new species of chameleon (Sauria: Chamaeleonidae) from the highlands of northwest Kenya. *Zootaxa* 3002:1–16.

Stipala, J., N. Lutzmann, P.K. Malonza, P. Wilkinson, B. Godley, J. Nyamache, and M.R. Evans. 2012. A new species of chameleon (Squamata: Chamaeleonidae) from the Aberdare Mountains in the central highlands of Kenya. *Zootaxa* 3391:1–22.

Stuart, S., J.S. Chanson, N.A. Cox, B.E. Young, A.S.L. Rodrigues, D.L. Fishman, and R.B. Waller. 2004. Status and trends of amphibian declines and extinctions worldwide. *Science* 306:1783–1786.

Stuart, S.N., and R.J. Adams. 1990. Biodiversity in sub-saharan Africa and its islands: conservation, management, and sustainable use. *Occasional Papers of the IUCN Species Survival Commission No. 6, VI*. Gland, Switzerland: IUCN.
Stuart-Fox, D. 2009. A test of Rensch's rule in dwarf chameleons (*Bradypodion spp.*), a group with female-biased sexual size dimorphism. *Evolutionary Ecology* 23:425–433.
Stuart-Fox, D.M., D. Firth, A. Moussalli, and M.J. Whiting. 2006b. Multiple signals in chameleon contests: designing and analysing animal contests as a tournament. *Animal Behaviour* 71:1263–1271.
Stuart-Fox, D., and A. Moussalli. 2007. Sex-specific ecomorphological variation and the evolution of sexual dimorphism in dwarf chameleons (*Bradypodion spp.*). *Journal of Evolutionary Biology* 20:1073–1081.
Stuart-Fox, D., and A. Moussalli. 2008. Selection for social signalling drives the evolution of chameleon colour change. *PLoS Biology* 6(1):e25.
Stuart-Fox, D., and A. Moussalli. 2009. Camouflage, communication and thermoregulation: lessons from colour changing organisms. *Philosophical Transactions of the Royal Society B* 364:463–470.
Stuart-Fox, D., and A. Moussalli. 2011. Camouflage in color changing animals: trade-offs and constraints, pp. 237–253. In M. Stevens and S. Merilaita, Eds., *Animal Camouflage: Mechanisms and Function*. Cambridge, United Kingdom: Cambridge University Press.
Stuart-Fox, D., A. Moussalli, and M.J. Whiting. 2007. Natural selection on social signals: Signal efficacy and the evolution of chameleon display coloration. *American Naturalist* 170:916–930.
Stuart-Fox, D., A. Moussalli, and M.J. Whiting. 2008. Predator-specific camouflage in chameleons. *Biology Letters* 4:326–329.
Stuart-Fox, D.M., and M.J. Whiting. 2005. Male dwarf chameleons assess risk of courting large, aggressive females. *Biology Letters* 1:231–234.
Stuart-Fox, D., M.J. Whiting, and A. Moussalli. 2006a. Camouflage and colour change: antipredator responses to bird and snake predators across multiple populations in a dwarf chameleon. *Biological Journal of the Linnean Society* 88:437–446.
Takahashi, H. 2008. Fruit feeding behavior of a chameleon *Furcifer oustaleti*: comparison with insect foraging tactics. *Journal of Herpetology* 42:760–763.
Talavera, R., and F. Sanchíz. 1983. Restos pliocénicos de Camaleón común, *Chamaeleo chamaeleon* (L.) de Málaga. *Boletín de la Real Sociedad Española de Historia Natural (Geología)* 81:81–84 [in Spanish].
Tauber, E.S., H.P. Roffwarg, and E.D. Weitzman. 1966. Eye movements and electroencephalogram activity during sleep in diurnal lizards. *Nature* 212:1612–1613.
Tauber, E.S., J.A. Rojas-Ramírez, and R. Hernández-Peón. 1968. Electrophysiological and behavioral correlates of wakefulness and sleep in the lizard *Ctenosaura pectinata*. *Electroencephalography and Clinical Neurophysiology* 24:424–433.
Thomas, C.D., A. Cameron, R.E. Green, M. Bakkenes, L.J. Beaumont, Y.C. Collingham, B.F.N. Erasmus, M.F. de Siqueira, A. Grainger, L. Hannah, L. Hughes, B. Huntley, A.S. van Jaarsveld, G.F. Midgley, L. Miles, M.A. Ortega-Huerta, A. Townsend Peterson, O.L. Phillips, and S.E. Williams. 2004. Extinction risk from climate change. *Nature* 427:145–148.
Thomas, H., J. Roger, S. Sen, J. Dejax, M. Schuler, Z. Al-Sulaimani, C. Bourdillon de Grassac, G. Breton, F. de Broin, G. Camoin, H. Cappetta, R.P. Carriol, C. Cavelier, C. Chaix, J.Y. Crochet, G. Farjanel, M. Gayet, E. Gheerbrant, A. Lauriat-Rage, D. Noël, M. Pickford, A.F. Poignant, J.C. Rage, J. Roman, J.M. Rouchy, S. Secrétan, B. Sigé, P. Tassy, and

S. Wenz. 1991. Essai de reconstitution des milieux de sédimentation et de vie des primates anthropoïdes de l'Oligocène de Taqah (Dhofar, Sultanat d'Oman). *Bulletin de la Société Géologique de France* 162:713–724 [in French].

Tilbury, C. 2010. *Chameleons of Africa—An Atlas, Including the Chameleons of Europe, the Middle East and Asia*. Frankfurt am Main, Germany: Edition Chimaira.

Tilbury, C.R. 1992. A new dwarf forest chameleon (Sauria: *Rhampholeon* Günther 1874) from Malawi, central Africa. *Tropical Zoology* 5:1–9.

Tilbury, C.R., and K.A. Tolley. 2009a. A re-appraisal of the systematics of the African genus *Chamaeleo* (Reptilia: Chamaeleonidae). *Zootaxa* 2079:57–68.

Tilbury, C.R., and K.A. Tolley. 2009b. A new species of dwarf chameleon (Sauria; Chamaeleonidae, *Bradypodion* Fitzinger) from KwaZulu Natal, South Africa with notes on recent climatic shifts and their influence on speciation in the genus. *Zootaxa* 2226:43–57.

Tilbury, C.R., K.A. Tolley, and W.R. Branch. 2006. A review of the systematics of the genus *Bradypodion* (Sauria: Chamaeleonidae), with the description of two new genera. *Zootaxa* 1363:23–38.

Tinkle, D.W., and J.W. Gibbons. 1977. The distribution and evolution of viviparity in reptiles. *Miscellaneous Publications Museum of Zoology, University of Michigan* 154:1–55.

Todd, M. 2011. Trade in Malagasy Reptiles and Amphibians in Thailand. Petaling Jaya, Selangor, Malaysia: TRAFFIC Southeast Asia.

Toerien, M.J. 1963. The sound-conducting systems of lizards without tympanic membranes. *Evolution* 17(4):540–547.

Tolley, K.A., and M. Burger. 2007. *Chameleons of Southern Africa*. Cape Town, South Africa: Struik.

Tolley, K.A., M. Burger, A.A. Turner, and C.A. Matthee. 2006. Biogeographic patterns and phylogeography of dwarf chameleons (*Bradypodion*) in an African biodiversity hotspot. *Molecular Ecology* 15(3):781–793.

Tolley, K.A., B.M. Chase, and F. Forest. 2008. Speciation and radiations track climate transitions since the Miocene Climatic Optimum: a case study of southern African chameleons. *Journal of Biogeography* 35:1402–1414.

Tolley, K.A., and G.J. Measey. 2007. Chameleons and vineyards in the Western Cape of South Africa: is automated grape harvesting a threat to the Cape Dwarf Chameleon (*Bradypodion pumilum*)? *African Journal of Herpetology* 56:85–89.

Tolley, K.A., R.N.V. Raw, R. Altwegg, and G.J. Measey. 2010. Chameleons on the move: survival and movement of the Cape Dwarf Chameleon, *Bradypodion pumilum,* within a fragmented urban habitat. *African Zoology* 45:99–106.

Tolley, K.A., C.R. Tilbury, W.R. Branch, and C.A. Matthee. 2004. Phylogenetics of the Southern African dwarf chameleons, *Bradypodion* (Squamata: Chamaeleonidae). *Molecular Phylogenetics and Evolution* 30:354–365.

Tolley, K.A., C.R. Tilbury, G.J. Measey, M. Menegon, W.R. Branch, and C.A. Matthee. 2011. Ancient forest fragmentation or recent radiation? Testing refugial speciation models in chameleons within an African biodiversity hotspot. *Journal of Biogeography* 38:1748–1760.

Tolley, K.A., T.M. Townsend, and M. Vences. 2013. Large-scale phylogeny of chameleons suggests African origins and rapid Eocene radiation. *Proceedings of the Royal Society of London Series B—Biological Sciences* 280(1759):20130184

Townsend, T., and A. Larson. 2002. Molecular phylogenetics and mitochondrial genomic evolution in the Chamaeleonidae (Reptilia, Squamata). *Molecular Phylogenetics and Evolution* 23(1):22–36.

Townsend, T.M., A. Larson, E. Louis, and J.R. Macey. 2004. Molecular phylogenetics of Squamata: the position of snakes, amphisbaenians, and dibamids, and the root of the squamate tree. *Systematic Biology* 53:735–757.

Townsend, T.M., D.G. Mulcahy, B.P. Noonan, B.P., J.W. Sites Jr., C.A. Kuczynski, J.J. Wiens, and T.W. Reeder. 2011a. Phylogeny of iguanian lizards inferred from 29 nuclear loci, and a comparison of concatenated and species-tree approaches for an ancient, rapid radiation. *Molecular Phylogenetics and Evolution* 61:363–380.

Townsend, T.M., K.A. Tolley, F. Glaw, W. Böhme, and M. Vences. 2011b. Eastward from Africa: palaeocurrent-mediated chameleon dispersal to the Seychelles islands. *Biology Letters* 7:225–228.

Townsend, T.M., D.R. Vieites, F. Glaw, and M. Vences. 2009. Testing species-level diversification hypotheses in Madagascar: the case of microendemic *Brookesia* leaf chameleons. *Systematic Biology* 58(6):641–656.

Toxopeus, A.G., J.P. Kruijt, and D. Hillenius. 1988. Pair-bonding in chameleons. *Naturwissenschaften* 75:268–269.

Trost, E. 1956. Über die lage des foramen parietals bei rezenten Reptilien und Labyrinthodontia. *Acta Anatomy* 26:318–339 [in German with English summary].

Uetz, P. 2012. The Reptile Database. Accessed at www.reptile-database.org on August 15, 2012.

Ullenbruch, K., P. Krause, and W. Böhme 2007. A new species of the *Chamaeleo dilepis* group (Sauria: Chamaeleonidae) from West Africa. *Tropical Zoology* 20:1–17.

Uller, T., D. Stuart-Fox, and M. Olsson. 2010. Evolution of primary sexual characters in reptiles, pp. 426–453. In A. Córdoba-Aguilar and J.L. Leonard, Eds., *The Evolution of Primary Sexual Characters in Animals*. Oxford, United Kingdom: Oxford University Press.

Underwood, G. 1970. The eye, pp. 1–97. In C. Gans, C. and T.S. Parsons, Eds. *Biology of the Reptilia. Volume 2. Morphology B*. New York: Academic Press.

Upchurch, G.R., B.L. Otto-Bliesner, and C. Scotese. 1998. Vegetation—atmosphere interactions and their role in global warming during the latest Cretaceous. *Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences* 353:97–112.

Upchurch, G.R.J., B.L. Otto-Bliesner, and C.R. Scotese. 1999. Terrestrial vegetation and its effects on climate during the latest Cretaceous. *Geological Society of America Special Papers* 332:407–426.

Van Bocxlaer, I., S.P. Loader, K. Roelants, S.D. Biju, M. Menegon, and F. Bossuyt. 2010. Gradual adaptation toward a range-expansion phenotype initiated the global radiation of toads. *Science* 327:679–682.

van der Meulen, A.J., I. García-Paredes, M.A. Álvarez-Sierra, L.W. van den hoek Ostende, K. Hordijk, A. Oliver, P. López-Guerrero, V. Hernández-Ballarín, and P. Peláez-Campomanes. 2011. Biostratigraphy or biochronology? Lessons from the Early and Middle Miocene small mammal events in Europe. *Geobios* 44:309–321.

van Leeuwen, J.L. 1997. Why the chameleon has spiral-shaped muscle fibres in its tongue. *Philosophical Transactions of the Royal Society of London Series B* 352(1353):573–589.

van Zinderen Bakker, E.M. 1975. The origin and palaeoenvironment of the Namib Desert biome. *Journal of Biogeography* 2:65–73.

Van Heygen, G., and E. Van Heygen. 2004. Eerste waarnemingen in de vrije natuur van het voortplantingsgedrag bij de tijgerkameleon *Calumma tigris* (Kuhl 1820). *TERRA—Antwerpen* 40:49–51.

Vanhooydonck, B., A. Herrel, R. Van Damme, J.J. Meyers, and D.J. Irschick. 2005. The relationship between dewlap size and performance changes with age and sex in a green anole (*Anolis carolinensis*) lizard population. *Behavioral Ecology and Sociobiology* 59(1):157–165.

Vanhooydonck, B., and R. Van Damme. 1999. Evolutionary relationships between body shape and habitat use in lacertid lizards. *Evolutionary Ecology Research* 1:785–805.
Vanhooydonck, B., Van Damme, R. and P. Aerts. 2002. Variation in speed, gait characteristics and microhabitat use in lacertid lizards. *Journal of Experimental Biology* 205:1037–1046.
Vanhooydonck, B., R. Van Damme, A. Herrel, and D.J. Irschick. 2007. A performance based approach to distinguish indices from handicaps in sexual selection studies. *Functional Ecology* 21:645–652.
Vejvalka, J. 1997. Obojživelníci (Amphibia: Caudata, Salientia) a plazi (Reptilia: Lacertilia, Choristodera) miocenní lokality Merkur–sever (Česká republika). M.Sc. Thesis, Charles University, Prague [in Czech].
Vences, M., F. Glaw, and C. Zapp. 1999. Stomach content analyses in Malagasy frogs of the genera *Tomopterna*, *Aglyptodactylus*, *Boophis* and *Mantidactylus* (Amphibia: Ranidae). *Herpetozoa* 11:109–116.
Vences, M., J. Kosuch, M.-O. Rödel, S. Lötters, A. Channing, F. Glaw, and W. Böhme. 2004. Phylogeography of *Ptychadena mascareniensis* suggests transoceanic dispersal in a widespread African-Malagasy frog lineage. *Journal of Biogeography* 31:593–601.
Vences, M., D.R. Vieites, F. Glaw, H. Brinkmann, J. Kosuch, M. Veith, and A. Meyer. 2003. Multiple overseas dispersal in amphibians. *Proceedings of the Royal Society of London Series B—Biological Sciences* 270:2435–2442.
Vences, M., K.C. Wollenberg, D.R. Vieites, and D.C. Lees. 2009. Madagascar as a model region of species diversification. *Trends in Ecology and Evolution* 24:456–465.
Vidal, N., and S.B. Hedges. 2005. The phylogeny of squamate reptiles (lizards, snakes, and amphisbaenians) inferred from nine nuclear protein-coding genes. *Comptes Rendus Biologies* 328:1000–1008.
Vidal, N., and S.B. Hedges. 2009. The molecular evolutionary tree of lizards, snakes, and amphisbaenians. *Comptes Rendus Biologies* 332:129–139.
Vinson, J., and J.-M. Vinson. 1969. The saurian fauna of the Mascarene islands. *Mauritius Institute Bulletin* 6:203–320.
Visser, J.G.J. 1972. Ontogeny of the chondrocranium of the chameleon, *Microsaura pumila* (Daudin). *Annale van die Universiteit van Stellenbosch* 47A:1–68.
Vitt, L. J. 2000. Ecological consequences of body size in neonatal and small-bodied lizards in the neotropics. *Herpetological Monographs* 14:388–400.
Von Volker, J.S. 1999. Litho- und biostratigraphische Untersuchungen in der Oberen Süsswassermolasse des Landkreises Biberach a. d. Riß (Oberschwaben) Stuttgarter. *Beiträge zur Naturkunde Serie B (Geologie und Paläontologie)* 276:1–167.
Vrolik, W. 1827. *Natuur - en Ontleedkundige Opmerkingen over den Chameleon*. Amsterdam: Meyer Warnars.
Wager, V.A. 1986. *The Life of the Chameleon*. Durban, South Africa: Wildlife Society.
Wainwright, P.C., and A.F. Bennett. 1992a. The mechanism of tongue projection in chameleons. I. Electromyographic tests of functional hypotheses. *Journal of Experimental Biology* 168:1–21.
Wainwright, P.C., and A.F. Bennett. 1992b. The mechanism of tongue projection in chameleons. II. Role of shape change in a muscular hydrostat. *Journal of Experimental Biology* 168:23–40.
Wainwright, P.C., D.M. Kraklau, and A.F. Bennett. 1991. Kinematics of tongue projection in *Chamaeleo oustaleti*. *Journal of Experimental Biology* 159:109–133.
Wall, G.L. 1942. *The Vertebrate Eye and its Adaptive Radiation*. New York: Hafner.
Wallach, V., W. Wüster, and D.G. Broadley. 2009. In praise of subgenera: taxonomic status of cobras of the genus *Naja* Laurenti (Serpentes: Elapidae). *Zootaxa* 2236:26–36.

Walter, R.C., P.C. Manega, R.L. Hay, R.E. Drake, and G.H. Curtis. 1991. Laser-fusion $^{40}Ar/^{39}Ar$ dating of Bed I, Olduvai Gorge, Tanzania. *Nature* 354:145–149.

Walton, B.M., and A.F. Bennett. 1993. Temperature-dependent color change in Kenyan chameleons. *Physiological Zoology* 66:270–287.

Wang, Y., and J.L. Li. 2008. Squamata, pp. 115–137. In J.L. Li, X.C. Wu, and F. Zhang, Eds., *The Chinese Fossil Reptiles and Their Kin*. Beijing, China: Science Press.

Wells, N.A. 2003. Some hypotheses on the Mesozoic and Cenozoic paleoenvironmental history of Madagascar, pp. 16–34. In S.M. Goodman and J.P. Benstead, Eds., *The Natural History of Madagascar*. Chicago: University of Chicago Press.

Werner, F. 1902a. Einer Monographie der Chamaleonten. *Zoologische Jahrbuecher. Systematik* 15:295–460.

Werner, F. 1902b. Zur Kenntnis des Skeletes von *Rhampholeon spectrum*. *Arbeiten aus dem Zoologishen Instituten der Universität Wien und der Zoologishen Station in Triest* 14:259–290.

Werner, F. 1911. Chamaeleontidae. *Das Tierreich* 27, I-XI:1–52.

Wessels, B.R., and B. Maritz. 2009. *Bitis schneideri* (Namaqua Dwarf Adder). Diet. *Herpetological Review* 40:440.

Wever, E.G. 1968. The ear of the chameleon: *Chamaeleo senegalensis* and *Chamaeleo quilensis*. *Journal of Experimental Zoology* 168(4):423–436.

Wever, E.G. 1969a. The ear of the chameleon: the round window problem. *Journal of Experimental Zoology* 171:1–5.

Wever, E.G. 1969b. The ear of the chameleon: *Chamaeleo höhnelii* and *Chamaeleo jacksoni*. *Journal of Experimental Zoology* 171(3):305–312.

Wever, E.G. 1973. Function of middle ear in lizards: divergent types. *Journal of Experimental Zoology* 184(1):97–125.

Wever, E.G., and Y.L. Werner. 1970. The function of the middle ear in lizards: *Crotaphytus collaris* (Iguanidae). *Journal of Experimental Zoology* 175(3):327–341.

Wheeler, P.E. 1984. An investigation of some aspects of the transition from ectothermic to endothermic metabolism in vertebrates. PhD thesis. University of Durham, North-Carolina.

White, F. 1983. The vegetation of Africa, a descriptive memoir to accompany the UNESCO/AETFAT/UNSO Vegetation Map of Africa (3 Plates, Northwestern Africa, Northeastern Africa, and Southern Africa, 1:5,000,000). Paris: UNESCO.

Wickens, G.E. 1976. *The Flora of Jebel Marra (Sudan Republic) and its Geographical Affinities*. London: Royal Botanic Gardens, Kew.

Wiens, J.J., M.C. Brandley, and T.W. Reeder. 2006. Why does a trait evolve multiple times within a clade? Repeated evolution of snake-like body form in squamate reptiles. *Evolution* 61:123–141.

Wiens, J.J., C.A. Kuczynski, T. Townsend, T.W. Reeder, D.G. Mulcahy, and J.W. Sites, Jr. 2010. Combining phylogenomics and fossils in higher level squamate reptile phylogeny: molecular data change the placement of fossil taxa. *Systematic Biology* 59:674–688.

Wild, C. 1994. Ecology of the Western pygmy chameleon *Rhampholeon spectrum* Buchholz 1874 (Sauria: Chamaeleonidae). *British Herpetological Society Bulletin* 49:29–35.

Wilkinson, M., S.P. Loader, D.J. Gower, J.A. Sheps, and B.L. Cohen. 2003. Phylogenetic relationships of African caecilians (Amphibia: Gymnophiona): insights from mitochondrial rRNA gene sequences. *African Journal of Herpetology* 52:83–92.

Williams, J. 2012. Humans and biodiversity: population and demographic trends in the hotspots. *Population & Environment* Epub before print.

Williams, S.C., and L.D. McBrayer. 2011. Attack-based indices, not movement patterns, reveal intraspecific variation in foraging behavior. Behavioural Ecology 22:993–1002.
Wilmé, L., S.M. Goodman, and J.U. Ganzhorn. 2006. Biogeographic evolution of Madagascar's microendemic biota. *Science* 312:1063–1065.
Wollenberg, K.C., D.R. Vieites, A. Van Der Meijden, F. Glaw, D.C. Cannatella, and M. Vences. 2008. Patterns of endemism and species richness in Malagasy cophyline frogs support a key role of mountainous areas for speciation. *Evolution* 62:1890–1907.
Wright, J.W., and D.G. Broadley. 1973. Chromosomes and the status of *Rhampholeon marshalli* Boulenger (Sauria: Chamaeleonidae). *Bulletin of the Southern California Academy of Science* 72:164–165.
Yoder, A.D., and M.D. Nowak. 2006. Has vicariance or dispersal been the predominant biogeographic force in Madagascar? Only time will tell. *Annual Review of Ecology and Systematics* 37:405–31.
Zachos, J.C., G.R. Dickens, and R.E. Zeebe. 2008. An early Cenozoic perspective on greenhouse warming and carbon-cycle dynamics. *Nature* 451:279–283.
Zachos, J.C., M. Pagani, L. Sloan, E. Thomas, and K. Billups. 2001. Trends, rhythms, and abberations in global climate 65 Ma to present. *Science* 292:686–693.
Zachos, J.C., M.W. Wara, S. Bohaty, M.L. Delaney, M.R. Petrizzo, A. Brill, T.J. Bralower, and I. Premoli-Silva. 2003. A transient rise in tropical sea surface temperature during the Paleocene-Eocene thermal maximum. *Science* 302:1551–1554.
Zani, P.A. 2000. The comparative evolution of lizard claw and toe morphology and clinging performance. *Journal of Evolutionary Biology* 13:316–325.
Zarcone, G., F.M. Petti, A. Cillari, P. Di Stefano, D. Guzzetta, and U. Nicosia. 2010. A possible bridge between Adria and Africa: New palaeobiogeographic and stratigraphic constraints on the Mesozoic palaeogeography of the Central Mediterranean area. *Earth-Science Reviews* 103:154–162.
Zari, T.A. 1993. Effects of body mass and temperature on standard metabolic rate of the desert chameleon. *Journal of Arid Environments* 24:75–80.
Zerova, G.A., and V.M. Chkhikvadze, 1984. Review of Cenozoic lizards and snakes of the USSR. *Izvestiya Akademii Nauk Gruzinskoi SSR, Seriya Biologicheskaya* 10:319–326. [in Russian].
Zhou, L., R.E. Dickinson, P. Dirmeyer, A. Dai, and S.-K. Min. 2009. Spatiotemporal patterns of changes in maximum and minimum temperatures in multi-model simulations. *Geophysical Research Letters* 36:L02702.
Zippel, K.C., R.E. Glor, and J.E.A. Bertram. 1999. On caudal prehensility and phylogenetic constraint in lizards: the influence of ancestral anatomy on function in *Corucia* and *Furcifer*. *Journal of Morphology* 239:143–155.
Zoond, A. 1933. The mechanism of projection of the chameleon's tongue. *Journal of Experimental Biology* 10:174–185.
Zoond, A., and J. Eyre. 1934. Studies in reptilian colour response. I. The bionomics and physiology of pigmentary activity of the chameleon. *Philosophical Transactions of the Royal Society of London, Series B* 223:27–55.

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6.2	Devi Stuart-Fox
6.3	Devi Stuart-Fox and Adnan Moussalli
6.4	Devi Stuart-Fox
8.1	Henrik Bringsøe
8.2	Krystal Tolley
8.3	Marius Burger
8.4	Marius Burger
8.5	Krystal Tolley
8.6	Marius Burger
8.7	Michele Menegon
8.8	William Branch
8.9	Krystal Tolley
8.10	Michele Menegon
8.11	Michele Menegon

INDEX

Figures cited without page numbers appear in the color insert.