

A Key to the Geckos (Sauria: Gekkonidae) of Florida

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ABSTRACT.—Currently, there is one native and 10 established non-native gekkonids in Florida. For nearly 100 years, gecko species in Florida have been misidentified because of their similar appearance to other lizards and a lack of well known morphological characters that distinguish each species. Because of the confusion regarding their identifications, we present a key to the gecko species of Florida along with their current geographic distributions.

Keywords.—Morphology, species, lizard, exotic, introduced, non-native

INTRODUCTION

Geckos are found throughout the world and belong to one of the most species-rich lizard families, second only to the skinks (Pough et al. 2001). The state of Florida has only a single native gekkonid, the Florida reef gecko, *Sphaerodactylus notatus* Baird 1859. Currently, there are 10 non-native geckos established in Florida (Table 1). Most of these geckos occur only in southern Florida, the region that extends from the northern edge of Lake Okeechobee south through the Florida Keys and contains nearly all known exotic herpetofaunal species in Florida. Misidentification of non-native geckos in Florida dates back to their earliest documentation. Fowler (1915) reported the first introduced gecko in Florida, the tropical house gecko, *Hemidactylus mabouia* (Moreau de Jonnés 1818), which was collected in 1910 on Key West, Monroe County. However, 80 years later this specimen (ANSP 18035) was identified by G. C. Mayer to actually be a Mediterranean gecko, *H. turcicus turcicus* (Linnaeus 1758) (N. Gilmore pers. comm.). More recently, McCoid (2002) reported *H. turcicus* from Charlotte County; however, this specimen (TCWC 84910) is actually *H. mabouia* (pers. obs.).

Many of the non-native lizard species in Florida are easily misidentified because of their similar appearance to other lizards and a lack of well known morphological characters that distinguish each species. In fact, there are now four introduced hemidactyline geckos in Florida, and these species are continuously misidentified due to the observer's lack of familiarity with key characters for each species. This most often occurs because these *Hemidactylus* are active nocturnally, and when found at night on a white wall they frequently lose all color pattern and appear pure white, making identification by pattern alone impossible.

Many other lizards in Florida, especially exotics, have also been misidentified throughout the years (for examples see King and Krakauer 1966; Wilson and Porras 1983; Townsend et al. 2003a, 2003b; Enge and Krysko 2004; Enge et al. 2004). Because of the confusion regarding the identification of lizards in Florida, we present a key to the gecko species of Florida along with their current geographic distributions. We focus on this group of lizards because of the large number of gekkonid species now residing in Florida. We do not consider two species, the Asian house gecko, *Cosymbotus platyurus* (Schneider 1792), and Bibron's thick-toed gecko, *Pachydactylus bibronii* (Smith 1845), to be part of Florida's herpetofauna at this time because these species are either confined to the

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TABLE 1. Gecko species in Florida. An asterisk after species name indicates the only native Florida gekkonid.

Species	Common name	Distribution	
		Southern Florida	Elsewhere in Florida
<i>Gekko gekko</i>	Tokay gecko	X	X
<i>Gonatodes albogularis</i>	Yellow-headed gecko	X	
<i>Hemidactylus frenatus</i>	Common house gecko	X	
<i>Hemidactylus mabouia</i>	Tropical house gecko	X	X
<i>Hemidactylus turcicus turcicus</i>	Mediterranean gecko	X	X
<i>Hemidactylus garnotii</i>	Indo-Pacific gecko	X	X
<i>Phelsuma madagascariensis grandis</i>	Madagascar giant day gecko	X	
<i>Sphaerodactylus argus argus</i>	Ocellated gecko	X	
<i>Sphaerodactylus elegans elegans</i>	Ashy gecko	X	
<i>Sphaerodactylus notatus notatus*</i>	Florida reef gecko	X	
<i>Tarentola annularis</i>	White-spotted wall gecko	X	

building in which they are known (Meshaka and Lewis 1994; Hauge and Butterfield 2000) or no voucher specimen exists in any known systematic collection.

MATERIALS AND METHODS

To determine the geographic distribution of each gecko species in Florida, records were obtained from the literature and systematic collections throughout the United States. Source acronyms follow Leviton et al. (1985). Outlier specimens (i.e., specimens from previously unknown areas) within systematic collections were either examined by us or curatorial staff within their respective institution to verify species identification. Additionally, collections were made throughout much of Florida from May 1992-December 2004. Specimens were collected by hand, with nooses (Strong et al. 1993), or fishing rods with insects for bait (Krysko 2000) and deposited in the Florida Museum of Natural History (FLMNH), University of Florida (UF collection). To create a dichotomous key, morphological characters distinguishing each species were obtained by examining specimens as well as from the literature.

A KEY TO THE GECKOS OF FLORIDA

We examined 1205 gekkonid specimens from Florida (Appendix), including 15 *Gekko gekko* (Linnaeus 1758), 99 *Gonatodes*

albogularis (Duméril and Bibron 1836), 30 *Hemidactylus frenatus* Duméril and Bibron 1836, 143 *H. garnotii* Duméril and Bibron 1836, 415 *H. mabouia*, 232 *H. turcicus turcicus*, 39 *Phelsuma madagascariensis grandis* Gray 1870, 13 *Sphaerodactylus argus argus* Gosse 1850, 90 *S. elegans elegans* MacLeay 1834, 121 *S. notatus notatus*, and 8 *Tarentola annularis* (Geoffroy de St-Hilaire 1827). Geckos differ from all other known lizard species in Florida by lacking eyelids. A key to the geckos of Florida is presented in Table 2.

Native gecko species

The Florida reef gecko, *Sphaerodactylus notatus notatus*, occurs throughout the Florida Keys, Monroe County, north along the southeastern Florida coast to Fort Lauderdale, Broward County (pers. obs.; Schwartz and Henderson 1991; Krysko and King 2002). This species is distinguished by having a vertical pupil, digits with lamellae but without widened subdigital lamellae (Fig. 2A), and dorsal scales that are relatively large, imbricate, and strongly-keeled (Table 2; Fig. 5A) (Barbour 1921; Savage 1954; Schwartz and Henderson 1991; Köhler 1999, 2003; Krysko and King 2002). Other characters include a light stripe bordered by brown extending from the snout through the eye and onto the back of neck; two dark-bordered light spots on the back of neck are present in juveniles and adult

TABLE 2. Key to the gecko species of Florida.

1a	Eyelids absent.....	2
b	Eyelids present.....	other lizard families in Florida
2a	Pupil round.....	3
b	Pupil vertical.....	4
3a	Digits with lamellae (Fig. 1a).....	<i>Phelsuma madagascariensis grandis</i>
b	Digits without expanded lamellae (Fig. 1b).....	<i>Gonatodes albogularis</i>
4a	Digits with widened subdigital lamellae (Fig. 2b).....	5
b	Digits without widened subdigital lamellae (Fig. 2a).....	9
5a	Medial subcaudals distinctly enlarged and arranged in series (Fig. 3a).....	6
b	Medial subcaudals not distinctly enlarged nor arranged in series (Fig. 3b).....	11
6a	Subdigital lamellae of digit IV extending to base of digit (Fig. 2b).....	7
b	Subdigital lamellae of digit IV do not extend to base of digit (Fig. 2c).....	<i>Hemidactylus mabouia</i>
7a	Dorsal tubercles large and in distinct lateral rows.....	<i>Hemidactylus turcicus turcicus</i>
b	Dorsal tubercles small or absent.....	8
8a	Second pair of anterior chin shields in contact with infralabials (Fig. 4a).....	<i>Hemidactylus frenatus</i>
b	Second pair of anterior chin shields not in contact with infralabials (Fig. 4b).....	<i>Hemidactylus garnotii</i>
9a	Dorsal scales relatively large, imbricate, and strongly-keeled (Fig. 5a).....	<i>Sphaerodactylus notatus notatus</i>
b	Dorsal scales relatively small and weakly-keeled or smooth (Figs. 5b, 5c).....	10
10a	Dorsal scales relatively small, slightly imbricate, and some weakly-keeled (Fig. 5b).....	<i>Sphaerodactylus argus argus</i>
b	Dorsal scales relatively small, smooth, granular, and juxtaposed (Fig. 5c).....	<i>Sphaerodactylus elegans elegans</i>
11a	Tail round with six rows of lateral and mid-dorsal tubercles of approximately the same size (Fig. 6a).....	<i>Gekko gecko</i>
b	Tail ventrally flattered with six lateral rows of different sized tubercles (Fig. 6b).....	<i>Tarentola annularis</i>

females, and maximum size of 34 mm SVL (Barbour 1921; Schwartz and Henderson 1991; Powell et al. 1998; Köhler 2003).

Non-native gecko species

The tokay gecko, *Gekko gecko*, occurs in scattered localities in Hollywood, Broward County, Fort Myers, Lee County, Tallahassee, Leon County, Miami, Miami-Dade County, and Key Largo, Plantation, and Little Torch keys, Monroe County. This species is distinguished by having a vertical pupil, digits with widened subdigital lamellae (Fig. 2B), medial subcaudals not distinctly enlarged nor arranged in series (Fig 3B), and tail rounded with six rows of lateral and mid-dorsal tubercles of approximately the same size (Table 2; Fig. 6A). Other characters include undivided lamellae; dorsum whitish-gray or bluish-gray with large orange, red, or brown blotches; and maximum size of about 185 mm SVL (Conant and Collins 1991).

The yellow-headed gecko, *Gonatodes albogularis*, is known from Fort Pierce, St. Lucie County; Miami, Goulds and Opa-

Locka, Miami-Dade County, and Key Largo, Boca Chicakey, Stock Island, and Key West, Monroe County (pers. obs.; Carr 1939), 1940; Duellman and Schwartz 1958; King and Krakauer 1966; Wilson and Porras 1983). However, the present ecological status of this species is uncertain because of apparent population declines (Krysko pers. obs.). This species is distinguished by having a round pupil and digits without expanded lamellae (Table 2; Fig. 1B) (Powell et al. 1998; Köhler 2003). Other characters include a dorsum with minute, even, granular scales; adult males are bluish, grayish-brown or black; tail black turning to gray with a white tip; head yellow above and orange-red below and onto the neck; juveniles and adult females are variegated light tannish or gray with irregular brown to black speckling and gray to brown blotches; and maximum size of 50 mm SVL (Barbour and Ramsden 1919; Fitch 1973; Schwartz and Henderson 1991; Köhler 1999, 2003; Savage 2002).

The common house gecko, *Hemidactylus frenatus*, occurs in Hollywood, Broward County, Fort Myers, Lee County, Miami,

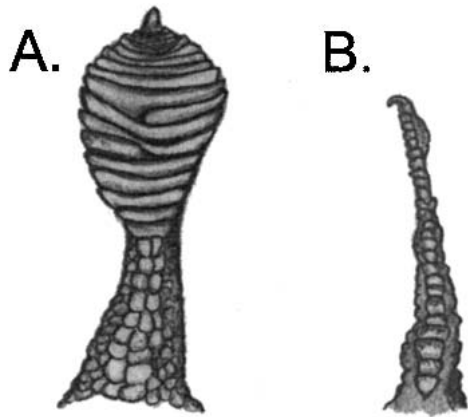


FIG. 1. Toes or fingers (A) with or (B) without lamellae. A = *Phelsuma madagascariensis grandis*, UF 132481, Grassy Key, Monroe County, Florida; B = *Gonatodes albogularis*, UF 7095, Key West, Monroe County, Florida.

Miami-Dade County, and Key West, Stock Island, and Big Pine Key, Monroe County (Townsend and Krysko 2003; Krysko et al. in press; Krysko and Sheehy in press). This species is distinguished by having a vertical pupil, digits with widened subdigital lamellae (Fig. 2B), medial subcaudals distinctly enlarged and arranged in a series (Fig. 3A), subdigital lamellae of digit IV extending to base of digit (Fig. 2B), small dorsal tubercles restricted to dorso-lateral rows, and second pair of anterior chin shields in contact with infralabials (Table 2;

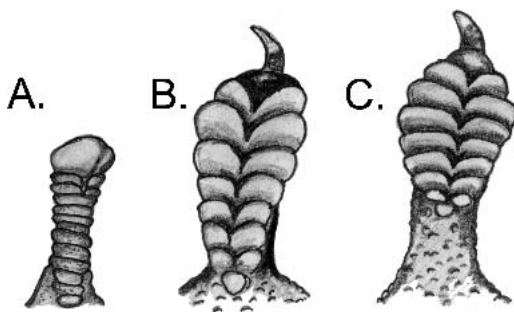


FIG. 2. Toes or fingers (A) without or (B, C) with widened subdigital lamellae. Subdigital lamellae of digit IV (B) do or (C) do not extend to base of digit. A = *Sphaerodactylus notatus notatus*, UF 131232, Plantation Key, Monroe County, Florida; B = *Hemidactylus turcicus turcicus*, UF 89632, Gainesville, Alachua County, Florida; C = *Hemidactylus mabouia*, UF 135980, Miami, Miami-Dade County, Florida.

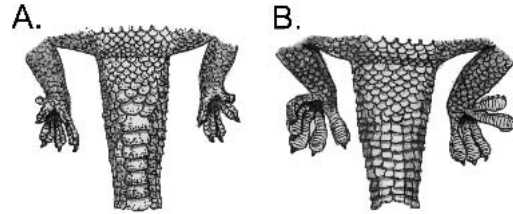


FIG. 3. Ventral view, medial subcaudals (A) distinctly enlarged and arranged in series or (B) not distinctly enlarged nor arranged in series. A = *Hemidactylus frenatus*, UF 141191, Stock Island, Monroe County, Florida; B = *Gekko gecko*, UF 135123, Plantation Key, Monroe County, Florida.

Fig. 4A) (Powell et al. 1998; Köhler 2003). Other characters include divided lamellae; dorsum and venter light in coloration, sometimes semi-transparent; a light line through eye; dark lateral stripe may be present; and maximum size of 60 mm SVL (Powell et al. 1998; Köhler 2003).

The Indo-Pacific gecko, *Hemidactylus garnotii*, is known from all of southern Florida (King and Krakauer 1966; Crowder 1974; Wilson and Porras 1983; Townsend and Krysko 2003), but populations have declined recently, especially in the Florida Keys, Monroe County. This species is distinguished by having a vertical pupil, digits with widened subdigital lamellae (Fig. 2B), medial subcaudals distinctly enlarged and arranged in a series (Fig. 3A), subdigital lamellae of digit IV extending to base of digit (Fig. 2B), small dorsal tubercles absent or small and restricted to dorso-lateral rows, and second pair of anterior chin shields not in contact with infralabials (Table 2; Fig. 4B) (Powell et al. 1998; Köhler 2003). Other characters include divided lamellae; tail

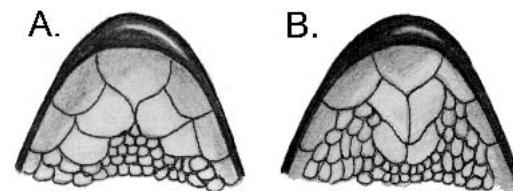


FIG. 4. Second pair of anterior chin shields (A) in contact or (B) not in contact with infralabials. A = *Hemidactylus frenatus*, UF 129782, Key West, Monroe County, Florida; B = *Hemidactylus garnotii*, UF 75524, Ochopee, Collier County, Florida.

dorso-ventrally compressed with a serrated lateral fringe and reddish-orange colored underside; dorsum and venter light in coloration, sometimes semi-transparent; occasionally dorsum black and venter yellow; distinct endolymphatic chalk sacs in adults; parthenogenetic reproduction; and maximum size of 65 mm SVL (Savage 2002; Köhler 2003).

The tropical house gecko, *Hemidactylus mabouia*, is found throughout all of southern Florida (Lawson et al. 1991; Butterfield et al. 1993; Meshaka et al. 1994; Krysko et al. 2003b; Townsend and Krysko 2003) and is now the most abundant gecko in this region. This species is distinguished by having a vertical pupil, digits with widened subdigital lamellae (Fig. 2C), medial subcaudals distinctly enlarged and arranged in a series (Fig. 3A), and subdigital lamellae of digit IV do not extend to base of digit (Table 2; Fig. 2C) (Schwartz and Henderson 1991; Powell et al. 1998; Köhler 2003). Other characters include divided lamellae, distinct tubercles; dorsum and venter light in coloration, sometimes semi-transparent; dorsum may be grayish or olive-brown with dark chevron markings; tail banded; and maximum size of 75 mm SVL (Köhler 2003).

The Mediterranean gecko, *Hemidactylus turcicus turcicus*, is known from much of southern Florida (Fowler 1915; Stejneger 1922; Barbour 1936; Carr 1940; Duellman and Schwartz 1958; King 1959; King and Krakauer 1966; Crowder 1974; Butterfield et al. 1993; Townsend and Krysko 2003), but now appears to have been extirpated in most areas it was once common in this region. This species is distinguished by having a vertical pupil, digits with widened subdigital lamellae (Fig. 2B), medial subcaudals distinctly enlarged and arranged in a series (Fig. 3A), subdigital lamellae of digit IV extending to base of digit (Fig. 2B), and dorsal tubercles large and in distinct dorso-lateral rows (Table 2) (Schwartz and Henderson 1991; Köhler 2003). Other characters include divided lamellae; dorsum and venter light in coloration, sometimes semi-transparent, with darker blotches and/or crossbands; tail and limbs cross-banded; and maximum size of 59 mm SVL

(Schwartz and Henderson 1991; Köhler 2003).

The Madagascar giant day gecko, *Phelsuma madagascariensis grandis*, occurs on Big Pine, Grassy, Little Torch, Plantation, and Sugarloaf keys, Monroe County (Krysko et al. 2003a; Krysko and Sheehy in press). This species is distinguished by having a round pupil and digits with expanded lamellae (Table 2; Fig. 1A). Other characters include a bright green dorsum with varying numbers and pattern of reddish-orange spots, a red stripe from the snout to the eye, white venter, and maximum size of about 140 mm SVL (Glaw and Vences 1994; Henkel and Schmidt 2000; Krysko et al. 2003a).

The ocellated gecko, *Sphaerodactylus argus argus*, occurs on Key West and Stock Island, Monroe County (Savage 1954; Wilson and Porras 1983; Krysko and King 2002; Krysko and Sheehy in press). This species is distinguished by having a vertical pupil, digits without widened subdigital lamellae (Fig. 2A), and dorsal scales relatively small, slightly imbricate, and some weakly-keeled (Table 2; Fig. 5B) (Barbour 1921; Savage 1954; Schwartz and Henderson 1991; Köhler 2003; Krysko and King 2002). Other characters include numerous light dorsal and lateral ocelli each comprised of more than one scale (Fig. 5B), ocelli on head and neck tending to form a lineate pattern, coral-red tail, and maximum size of 33 mm SVL (Barbour 1910, 1921, 1922; Schwartz and Henderson 1991; Krysko and King 2002).

The ashy gecko, *Sphaerodactylus elegans elegans*, occurs in Miami, Miami-Dade County, and throughout the Florida Keys, Monroe County (Stejneger 1922; Wilson and Porras 1983; Schwartz and Henderson 1991; Krysko and King 2002). This species is distinguished by having a vertical pupil, digits without widened subdigital lamellae (Fig. 2A), and dorsal scales relatively small, smooth, granular, and juxtaposed (Table 2; Fig. 5C) (Barbour 1921; Schwartz and Henderson 1991; Powell et al. 1998; Krysko and King 2002). Other characters include numerous light dorsal and lateral ocelli each comprised of only a single scale (Fig. 5C), neonates grayish with distinct black bands and a coral-red tail, and maximum

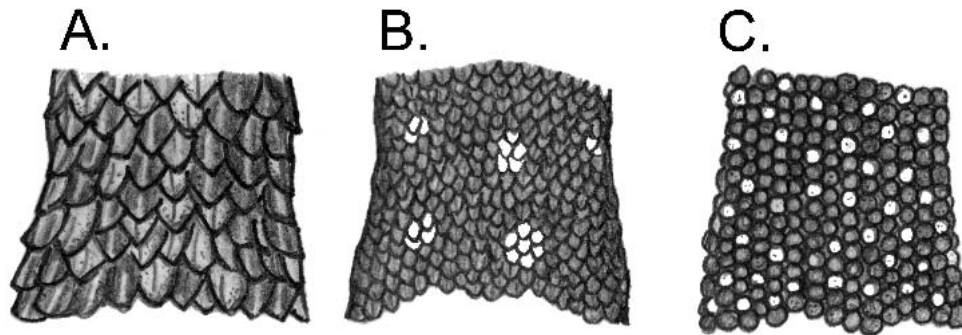


FIG. 5. Dorsal scales (A) relatively large, imbricate, and strongly-keeled; (B) small, slightly imbricate, and some weekly-keeled; or (C) small, smooth, granular, and juxtapsed. A = *Sphaerodactylus notatus notatus*, UF 131233, Cape Sable, Monroe County, Florida; B = *Sphaerodactylus argus argus*, UF 43310, Key West, Monroe County, Florida; C = *Sphaerodactylus elegans elegans*, UF 132437, Key West, Monroe County, Florida.

size of 39 mm SVL (Barbour 1921; Schwartz and Henderson 1991; Krysko and King 2002).

The white-spotted wall gecko, *Tarentola annularis*, occurs in isolated areas in Fort Myers, Lee County, and Florida City, Miami-Dade County. This species is distinguished by having a vertical pupil, digits with widened subdigital lamellae (Fig. 2B), medial subcaudals not distinctly enlarged nor arranged in series (Fig. 3B), and tail ventrally flattened with a total of six lateral and mid-dorsal rows of different sized tubercles (Table 2; Fig. 6B). Other characters include undivided lamellae; dorsum gray with large tubercles in distinct lateral rows; a thin dark stripe extending from the snout through the eye; dark posterior-pointed markings on dorsum, the first two dark markings with four white lateral spots; tail crossbanded; lower lateral tubercles on tail

greatly projected (Fig. 6B); and maximum size of 104 mm SVL.

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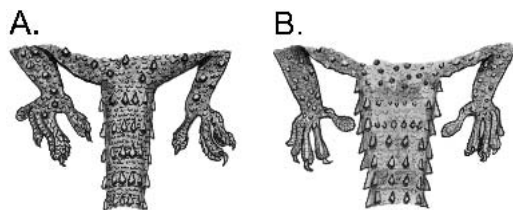


FIG. 6. Dorsal view, tail (A) round with six rows of lateral and mid-dorsal tubercles of approximately the same size or (B) ventrally flattened with six lateral and mid-dorsal rows of different sized tubercles. A = *Gekko gecko*, UF 135123, Plantation Key, Monroe County, Florida; B = *Tarentola annularis*, UF 137010, Florida City, Miami-Dade County, Florida.

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- Hemidactylus frenatus*.—UF 121176, 121480-82, 129784, 131441-43, 133220-26, 133229, 133231, 133236, 135124, 137009, 137067-68, 137088, 137121, 137408, 137419-20, 141190-91, 141216.
- Hemidactylus garnotii*.—ANSP 32623-24; UF 21989, 32553, 39065, 41500-03, 43749-54, 44142, 44148, 50114, 53909-10, 61150-51, 65472, 69310, 70548-51, 71961, 75524, 75527, 78074, 79999, 80038, 80802, 81525, 83861, 86915, 87231-35, 87721-24, 87825-27, 90660-66, 91872, 94949, 99771-72, 103040, 103797, 112984, 115255-56, 115628, 115971, 116050, 116164-65, 117538, 118830, 119540, 120756, 121506, 122887-90, 122896-97, 123135, 123868, 123890-95, 124216-17, 124688, 125932, 126745-48, 127282, 128022, 128024, 129232-33, 129829, 131550, 132685, 132701-03, 133228, 133230, 134315, 135291-92, 135971, 136981, 137069, 137078, 137343, 137686-88, 140123-24, 140566-72, 141182, 141235, 141645, 141701, 142048, 142318-21, 142549, 142575.
- Hemidactylus mabouia*.—UF 80611-13, 98769, 98774-80, 98783-95, 98818, 113323-31, 120798, 120909-10, 121313-26, 121400-06, 121409, 121417-21, 121428-29, 121455-57, 121464, 121468-79, 121481-502, 122466-69, 122782, 122899-900, 123873-83, 124076-80, 125930-31, 126741, 127710-30, 129226-30, 129771-80, 129783, 129785-829, 130689, 130704-16, 130741-59, 130761-64, 130769-70, 131443, 131455-56, 131462, 131472-74, 131506, 131517-18, 131769, 132453, 132456, 132459-60, 132467-69, 132668-79, 132690-92, 132704-09, 132712-20, 132728-32, 133233-35, 133250, 133842-43, 134223, 134316-17, 134948-64, 134968-90, 135045, 135074, 135174, 135474-75, 135477, 135492, 135628, 135972, 135979-80, 136005-07, 136042, 136077, 136989-96, 137001, 137004, 137013, 137022, 137079-85, 137123-25, 137210-13, 137277-85, 137414-16, 137421-24, 137507-09, 137713, 138415, 140561, 140590, 140723, 140826, 140836-37, 141185-89, 141193-97,

Appendix.

Gecko specimens examined from Florida.

Gekko gekko.—UF 91871, 103506-07, 132435-36, 132446, 133237-39, 135122-23, 137209, 137218, 141580-81.

Gonatodes albogularis.—AMNH 93789, 139565; CAS 172089, 174327; CU 3305; FMNH 83215, 209439-40; FWM 7545, 9837; GMNH 3696; ISU 575; KU 68965-66; LACM

141202-04, 141206-11, 141213-14, 141485, 141499, 141503-12, 141702, 142597, 142692-93, 142704-07.

Hemidactylus turcicus turcicus.—TCWC 84910; UF 616, 7096, 8917, 9283, 40645-50, 41495-99, 66941, 69311-14, 71520-25, 73733-39, 74994, 86482, 86816, 86875-82, 87274, 87702-14, 87725-31, 87818-24, 87828-40, 89629-30, 89632-51, 89653-55, 91969, 93619, 94152-53, 98749, 99770, 103502, 103697, 104899, 112976, 115970, 117754, 118997, 120792, 121185-86, 123265, 124200, 124304, 124750-51, 124805, 126834-38, 126853, 126941, 127130-32, 128020-21, 128023, 128025-28, 131718, 133844-46, 133934, 134604, 134965-67, 137269, 137426-27, 138218, 138388, 139397-98, 141252-56, 141618, 141643, 141646, 141769, 142550.

Phelsuma madagascariensis grandis.—UF 130735-37, 131553-55, 132481-93, 133832, 133938-43, 135046, 135078-80, 135121, 137342, 137661, 137725, 137803, 140503, 140722, 141776, 141813.

Sphaerodactylus argus argus.—CAS-SU 10439-40, 10442; LACM 61282-86; MCZ R-183052-53; UF 43310, 141192, 141217.

Sphaerodactylus elegans elegans.—UF 183, 494, 2033, 2903, 7099, 7785, 8621, 21845, 22112, 66942, 75227, 84234, 95428-36, 98819-20, 123456-58, 126743, 126823, 127016, 127058-71, 127136, 127201, 130738-40, 130766-68, 131768, 132020, 132023, 132382, 132384-85, 132437-38, 132442-44, 132454-55, 132667, 132978, 133203, 133820, 137216, 137216, 137418, 141042, 141513, 142687-88, 142713.

Sphaerodactylus notatus notatus.—UF 617, 1300, 1813, 2151, 7784, 8622-23, 12051, 14029, 19214, 22186, 43586, 67917, 74996, 75228, 91848-50, 96844-55, 123455, 126350, 126742, 127135, 127137, 127171-75, 131200-44, 131552, 131767, 132021-22, 132383, 132439-41, 132689, 132979, 133096, 135793; UMMZ 108350, 109392.

Tarentola annularis.—UF 133240-44, 137010-11, 137055.