MATTHEW E. GIFFORD

Like many male anoles, Grenada Bush Anoles (*Anolis aeneus*) from Union Island erect nuchal and dorsal crests when reacting to another male or a perceived threat, which in this instance was the photographer.

The Reptiles of Union Island, St. Vincent and the Grenadines

Daniel P. Quinn[1], Audrey L. McTaggart[2], Tess A. Bellah[3], Ehren J. Bentz[4], Luke G. Chambers[5], Hayden D. Hedman[6], Rebecca John[7], Deborah N. Muñiz Pagan[8], and Mel J. Rivera Rodríguez[8]

[1]Department of Biology, Truman State University, Kirksville, Missouri 63501, USA
[2]Department of Biology, McPherson College, McPherson, Kansas 67460, USA
[3]Department of Biology, Avila University, Kansas City, Missouri 64145, USA
[4]Department of Biology, Oregon State University, Corvallis, Oregon 97331, USA
[5]Department of Biology, William Jewell College, Liberty, MO 64068, USA
[6]Department of Ecology and Evolutionary Biology, University of Colorado, Boulder, Colorado 80301, USA
[7]Departments of Environmental Studies and Biology, University of California, Santa Cruz, California 95064, USA
[8]Department of Biology, University of Puerto Rico, Mayagüez, Puerto Rico 00681

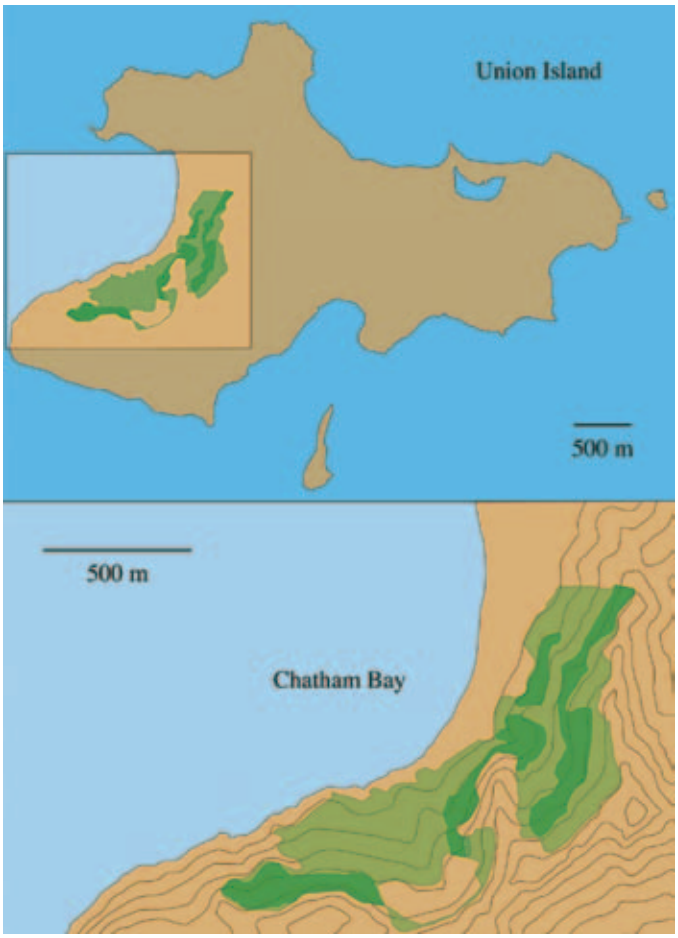
Union Island is located on the Grenada Bank midway between Grenada and St. Vincent and is equidistant from Barbados, Trinidad, and Martinique. Archeological studies show that Amerindian tribes settled here as early as 5400 BC and, since that time, used it as a stop-off point on their journeys until Europeans arrived in the 1750s (Homer and Collins 2008). In the late 18th century, slave traders and plantation owners cleared the land. Most was devoted to the farming of export crops (e.g., cotton; Howard 1952). Consequently, the island's forests are secondary, with the oldest extant forest (above Chatham Bay on the western side of the island) dating to 1834, when slavery was abolished and some of the island's large-scale cultivation came to an end. However, the plantation system continued until at least 1891, when Union is reported to have produced 34,200 lbs of cotton (Howard 1952). Presently, Union has a human population of about 3,000 and remains relatively undisturbed, especially above Chatham Bay and on the slopes of Mt. Taboi, the highest peak on the island.

With an area of approximately 8.4 km^2 and a maximum elevation of only 330 m, Union is not high enough to "snag" cloud and trigger rainfall; an average of only 1,000 mm annually renders it a "dry island" (Daudin and de Silva 2007). As a result, its native vegetation is characterized as seasonal dry forest (Fiard 2003). Consequently, and in sharp contrast to the larger and more topographically diverse islands in the region, Union lacks native amphibians altogether, although drought-tolerant reptiles are locally abundant and surprisingly diverse.

Few herpetofaunal studies have been conducted on Union. Herein we present a summary of our June 2010 observations of Union's reptilian diversity, including some yet unpublished data. Our intent is to facilitate future research, a better understanding of small-island ecology, and the implementation of management plans capable of regulating or preventing potentially harmful development, especially in sensitive and important habitats such as the slopes above Chatham Bay. This habitat not only contains the highest diversity on Union (all species in this checklist are known to occur at this site with the sole exception of *Gymnophthalmus underwoodi*), it also contains the only known population of the Union Island Gecko, *Gonatodes daudini* (Powell and Henderson 2005, Daudin and de Silva 2007). Preservation of this area is a key to the conservation of Union's reptilian diversity.

Turtles (Reptilia: Testudines)

Chelonoidis carbonaria (Spix 1824). Family Testudinidae. English common name: Red-footed Tortoise. Neotropical endemic. Most likely introduced by Amerindians from the South American mainland (Daudin and de Silva 2007, Hansen 2010). The carapace is domed and varies from hatchling lengths of 45–63 mm to a maximum of 600 mm for males and 400 mm for females (Ernst and Leuteritz 1999). Union turtles are smaller (adult males average 301 mm, adult females 264 mm; Hedman et al., in press). *Chelonoides carbonaria* is abundant in various habitats throughout the island. This species is omnivorous, but tends more toward herbivory, feeding on fruit, leaves, flowers, carrion, and even feces (Daudin and de Silva 2007). Listed in CITES Appendix II.



Map of Union Island, emphasizing the critically important habitat on the slopes above Chatham Bay (green) and areas providing habitat for the Union Island Gecko (*Gonatodes daudini*) with moist litter associated with rocky outcrops (dark green).

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The most frequently observed posture of Union Island Geckos (*Gonatodes daudini*) is hanging upside-down in a rock crevice above dense leaf litter.

ROBERT POWELL

Clifton Harbor is the largest town on Union Island. Carriacou, one of the Grenada Grenadines is visible in the distance.

ROBERT POWELL

A view of a fringing reef and nearby Palm Island from Union Island. The airport runway is just out of the image to the lower left.

MEL J. RIVERA RODRÍGUEZ

Critical habitat is provided by the old secondary forests in the area above Chatham Bay, on the northwestern slope of Mt. Taboi. Clearings for agricultural or residential purposes are evident near the far (northern) end of the area and a resort, currently servicing the yachts that anchor in the bay, can be seen expanding up the slope.

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Although Red-footed Tortoises (*Chelonoidis carbonaria*) are utilized as a food resource throughout much of their range (Farias et al. 2007), Union islanders shun the consumption of Red-footed Tortoises because of their indiscriminate diet that can include carrion and feces (Daudin and de Silva 2007).

Lizards (Reptilia: Squamata)

Hemidactylus mabouia (Moreau de Jonnés 1818). Family Gekkonidae. Local name: Wood Slave. English common name: Tropical House Gecko. Originating in the Eastern Hemisphere, these geckos are widely distributed in the Americas. The Union Island population is probably introduced, but might be descended from ancestors that arrived via natural overwater dispersal from the South American mainland or they could be of mixed origins. Tropical House Geckos are known to feed on arthropods, particularly dipterans, but might take small vertebrates and have even been known to engage in cannibalism (Bonfiglio et al. 2006). Like many geckos, *H. mabouia* varies in color. Typically very pale at night, individuals can be dark with light to dark brown crossbands. Although superficially similar to a small Turnip-tailed Gecko (*Thecadactylus rapicauda*), the two species can be distinguished by their toes. *Thecadactylus* digits are strongly dilated and webbed, and its retractile claws can be sheathed in a fold of skin, whereas toes of *Hemidactylus* are less widely expanded, not webbed, and lack retractile claws.

Thecadactylus rapicauda (Houttuyn 1782). Family Phyllodactylidae. Local name: Wood Slave (often confused with *H. mabouia*). English common name: Turnip-tailed Gecko. This Neotropical endemic (Russell and Bauer 2002) is most likely native to Union. These relatively large geckos (maximum SVL on St. Vincent 121 mm; Treglia 2006) are superficially similar to *H. mabouia*, but, in addition to size, can be distinguished by sheaths over their claws and a distinctive swollen tail when regenerated, hence the common name. Geckos on Union appear to be smaller than those known from elsewhere in the species' range. Predominantly nocturnal, these geckos are mostly encountered on tree trunks on Union. In regions where *H. mabouia*

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Native to Sub-Saharan Africa but widely distributed in mainland South America, *Hemidactylus mabouia* might have arrived in the West Indies either by natural over-water dispersal or as a hitchhiker with Amerindians (Jesus et al. 2001). These geckos thrive in disturbed areas that include human structures and dwellings (e.g., Ávila-Pires 1995, Vanzolini 1968).

does not reside, *T. rapicauda* tends to be edificarian (found on and in buildings) as well (Vitt and Zani 1997). Most activity occurs before midnight (Germano et al. 2003, Vitt and Zani 1997). Primarily insectivorous, *T. rapicauda* is an ambush forager (Cooper 1994, Cooper et al. 1999). Studies of other sympatric geckos species have found high rates of spatial competition on man-made structures (Case and Bolger 1991). Although known to co-occur on buildings on other Antillean islands (e.g., Howard et al. 2001, Daniells et al. 2008), competitive interactions between *T. rapicauda* and *H. mabouia* might be partly responsible for their distribution on Union, where no *T. rapicauda* was seen on or in human-made structures.

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The Turnip-tailed Gecko (*Thecadactylus rapicauda*) is frequently confused with the Woodslave (*Hemidactylus mabouia*), although its large, swollen regenerated tail and sheathed claws readily distinguish the two.

Sphaerodactylus kirbyi (Lazell 1994). Family Sphaerodactylidae. English common name: Grenadine Sphaero. This Grenada Bank endemic (Powell and Henderson 2005) has a maximum SVL of 29 mm. *Sphaerodactylus kirbyi* is diurnal and lives in leaf litter, under rocks and fallen logs, and near termite mounds. On Union, it appears to be restricted to the relatively lush forests above Chatham Bay, where it is associated with areas of deep litter, in contrast to the ecologically similar Union Island Gecko, which is found primarily on and around rock outcroppings. Its diet consists of small arthropods. Dorsal ground color is gray-brown with markings varying from numerous small dark gray blotches to patternless. The venter is dark gray with faint stripes around the neck. In most individuals a V-shaped gray-black line begins in the area of the hind legs and extends onto the tail. The underside of the tail is a slight rosy-orange. Chin, throat, and sides of the head are yellowish.

Gonatodes daudini (Powell and Henderson 2005). Family Sphaerodactylidae. Local name: Union Island Gecko. English common name: Grenadines Clawed Gecko. Apparently a Union Island endemic (known only from the island) and the only member of the genus endemic to the Antilles (Powell and Henderson 2005), this small gecko (average SVL = 27.8 mm, average mass = 0.56 g) presumably feeds on arthropods (based on habits of other congeners; e.g., Vitt et al. 2000). With a bright red-orange iris and dorsolateral white spots surrounded by black and larger

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The Grenadine Sphaero (*Sphaerodactylus kirbyi*) is the smallest reptile on Union, weighing an average 0.3 g.

concentric red rings on a dark green ground color (Powell and Henderson 2005), these little lizards appear to have been decorated for the holidays. Apparently crepuscular, *G. daudini* seems to cease activity when ambient air temperatures exceed those under boulders and logs or in the crevices of rock outcroppings where geckos seek shelter during the day. The slopes above Chatham Bay provide the only habitat where a population is known to exist.

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Known to occur only on the slopes above Union's Chatham Bay, the Union Island Gecko (*Gonatodes daudini*) could be driven to extinction if proposed plans for developing the bay area are implemented (Daudin and de Silva 2007).

ROBERT POWELL

The Grenada Bush Anole (*Anolis aeneus*) is ubiquitous throughout Union, and the most commonly encountered species on the island. Found on trees, deadfall and other debris, and man-made structures such as fences and buildings, this arboreal lizard is not timid, and is known to direct territorial displays toward humans who venture too close.

Anolis aeneus (Gray 1840). Family Polychrotidae. Local name: Tree Lizard. English common name: Grenada Bush Anole. Endemic to the Grenada Bank, the largest individual recorded (SVL = 73 mm) on Union was slightly smaller than the maximum size of individuals from Grenada (SVL = 77 mm; D. Crews in Stamps 1977) and an introduced population in Guyana (SVL = 80 mm; Lazell 1972). Tolerant of both xerophilic and mesophilic conditions (Schwartz and Henderson 1991), these lizards are active from dawn to dusk and are ubiquitous in natural and human-altered habitats on

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Although not as large as conspecifics on some other islands, Green Iguanas (*Iguana iguana*) are the largest reptiles on Union. These bulky lizards are diurnal but were frequently seen at night sleeping in tree canopies.

Union. *Anolis aeneus* is predominantly insectivorous, but larger individuals on Grenada engage in herbivory (Schoener and Gorman 1968). Ground color varies from dark gray to green and pale tan, and some individuals have spots and/or dorsolateral stripes. Males have a bright yellow dewlap. Males especially are approachable, do not frighten easily, and will perform push-ups, dewlap extensions, and head-bobbing, all considered signs of territoriality (Stamps and Barlow 1972), when approached by people. When disturbed, however, these lizards tend to "squirrel" around to the opposite side of their perch, but eventually move upward, often to the highest branches of a tree.

Iguana iguana (Linnaeus 1758). Family Iguanidae. Local name: Iguana. English common name: Green or Common Iguana. These Neotropical endemics are the largest reptiles on Union. They are diurnal, spending nights sleeping in tree canopies. We saw few adults on Union, where they are hunted for food. In contrast, individuals of all ages are abundant where they are protected on nearby islands (e.g., Palm Island and Tobago Keys). While coloration varies from pale tan to bright green, and many adults have black or white transverse bars, the smaller individuals on Union were uniformly green. A dorsal crest and a large scale below each ear opening are prominent. Iguanas are completely herbivorous (Troyer 1984), although some reports indicate that juveniles will take insects and some individuals will scavenge (Henderson and Powell 2009). Very agile for their build, iguanas will tail-whip in defense, but typically will not bite unless incited (Swanson 1950). Listed in CITES Appendix II.

Mabuya sp. (Lacépède 1788). Family Scincidae. Local name: Snake Servant. English common name: Lesser Antillean Skink. The taxonomic status of West Indian populations currently assigned to the genus *Mabuya* is poorly resolved, and populations on each island bank should be considered endemic to that bank until detailed studies have been conducted. Skinks are rare on all islands save Dominica (Malhotra et al. 2007). Antillean skinks usually are associated with tropical dry scrub and arid regions (e.g., Rivero 1978). Although primarily terrestrial, they readily climb into high vegetation or even on buildings. With a bronze ground color and a dark lateral stripe, skinks superficially resemble *Gymnophthalmus underwoodi*,

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The Lesser Antillean Skink (*Mabuya mabouya*) is primarily terrestrial; however, it will readily climb trees, boulders, and buildings to bask or forage.


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To escape predators, the Ground Lizard (*Ameiva ameiva*) will bipedal and can reach peak speeds approaching 300 cm/sec. Adults (left) are not territorial and frequently forage in close proximity to one another, although fights and chases occasionally ensue when paths converge. Juveniles (right) have a distinct striped pattern, which blends well with surroundings as individuals move through grass or open vegetation.

with which they are sometimes confused. However, skinks are substantially larger (maximum SVL = 87 mm for males and 93 mm females; Schwartz and Henderson 1991). Exclusively diurnal, with an activity peak at midday (Rocha et al. 2009), these active foragers feed mostly on insects and wood lice (Malhotra and Thorpe 1999).

Ameiva ameiva tobagana (Cope 1879). Family Teiidae. Local name: Ground Lizard. English common name: Giant Ameiva. These large (average male SVL on Union = 98 mm, average female SVL = 89 mm) Neotropical endemics are often heard scurrying through vegetation. They tend to thrive in warm/dry environments (e.g. grassy beaches, dry shrub, and under beachside *Coccoloba* trees). The head is large and narrow and a bifurcated snake-like tongue is used to find food. *Ameiva ameiva* is an omnivorous active forager, rooting in leaves and gravel for small arthropods and seeds. They have been seen scavenging road-killed animals on Union. The ground color is gray laterally and ventrally suffused with blue or green, with the blue color most prominent in males. Active predominantly during the morning and early afternoon, activity is curtailed and stops altogether by late afternoon. If threatened, these lizards take flight with surprising speed and often run on their hindlimbs.

Gymnophthalmus underwoodi (Grant 1958). Family Gymnophthalmidae. Local name: Snake Servant (often confused with *Mabuya* sp.). English common name: Smooth-scaled Worm Lizard. These Neotropical endemics are most likely native on Union. However, they are adept colonizers and are being recorded from an increasing number of Antillean islands. Colonization is facilitated by parthenogenic reproduction (i.e., all individuals are females and can reproduce without a male; Hardy et al. 2005). These are small lizards (maximum SVL = 48 mm) with a tail as long or longer than the head and body. Quite heat-tolerant and active by day, Worm Lizards are encountered mostly in and under leaf litter (e.g., Germano et al. 2003), especially in areas with an open canopy that allows sunlight to penetrate. They are bronze/brown dorsally with the sides a shade darker. The tail is long and slender and breaks easily, which appears to serve as a means of escaping predators. These lizards are quick and evade capture by running, turning sharply, and porpoising through leaf litter.

Bachia heteropa alleni (Barbour 1914). Family Gymnophthalmidae. Local name: Unknown. English common name: Earless Worm Lizard. This Neotropical endemic occurs on the South American mainland, Trinidad, Tobago, and the Grenada Bank (Dixon 1973, Henderson and Powell


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Often confused with skinks, Smooth-scaled Worm Lizards (*Gymnophthalmus underwoodi*) are substantially smaller, with a maximum head-and-body length of less than 5 cm.


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Earless Worm Lizards (*Bachia heteropa*) move in a serpentine fashion, using their long tails for locomotion when on the surface; their reduced legs might serve as anchors when burrowing underground.


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ROBERT POWELL

We encountered only a few light yellow-orange colored Grenada Bank Treeboas (*Corallus grenadensis*; left), most snakes on Union had a taupe ground color with a dark pattern (right). Population densities are relatively low in the dry forests of Union compared to densities on larger, more mesic islands on the Grenada Bank.

2009). Individuals on Union reach a SVL of ~50 mm, with a tail that can be as much as 1.5 times as long as the head and body. The long tails are used in escape behaviors, such as tail-slapping and burrowing (John et al., in press). The basic pattern of the subspecies that occurs on the Grenada Bank involves three dark longitudinal dorsal lines that extend from the back of the head onto the tail. The sides are dark brown to blackish and the venter is light brown. Populations are locally dense on Union, especially in the shaded forests on the slopes above Chatham Bay. They are always under cover (logs, termite mounds, rocks; e.g., Germano et al. 2003), where they feed on small arthropods.

Snakes (Reptilia: Squamata)

Corallus grenadensis (Barbour 1914). Family Boidae. Local name: Congo Snake. English common name: Grenada Bank Treeboa. This Grenada Bank endemic occurs in a wide range of habitats from mature forest to dry scrub, but requires a contiguous canopy as they are loathe to descend to the ground (Henderson 2002). Nocturnally active, juveniles actively forage for sleeping anoles whereas adults feed almost exclusively on small rodents (Yorks et al. 2003a). Colors vary dramatically (Henderson 2002); on Union, most individuals are taupe with darker markings, but we encountered a few yellow snakes. Population densities on Union are low compared to most habitats on Grenada, but comparable to the drier habitats on the larger island (Quinn et al., in press). Boas are readily detected by their reflective eye-shine when in a beam of light. Although calm when approached, boas readily bite and musk if handled. Listed in CITES Appendix II.

Mastigodryas bruesi (Barbour 1914). Family Colubridae. Local name: White Snake. English common name: Windward Tree Racer. This species is endemic to the Grenada and St. Vincent island banks (Greene et al. 2003). The diet of these slender-bodied diurnally active snakes consists primarily of frogs and lizards (mostly *Eleutherodactylus* and *Anolis*; Henderson and Powell 2009); however, due to the absence of frogs on Union, *M. bruesi* most likely feeds exclusively on lizards. Dorsal coloration is bluish gray to brown with light lateral stripes, a light venter, and a dark eye line. They are typically arboreal when sleeping but are regularly spotted on the ground sunbathing or traveling between stands of trees during the day. When threatened, however, individuals on Union escape almost exclusively by climbing rapidly into trees (Rivera Rodríguez et al., in press-a).

Tantilla melanocephala (Linnaeus 1758). Family Colubridae. Local name: unknown. English common name: Black-headed Snake. Native to the Neotropical mainland, Trinidad, and Tobago and introduced on Union


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The White Snake (*Mastigodryas bruesi*) is the only one of Union's snake species that is active and frequently encountered during the day.


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The Black-headed Snake (*Tantilla melanocephala*) is a small, inconspicuous species only recently introduced onto islands of the Grenada Bank.

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Until its rediscovery this year in the Chatham Bay area on Union Island, the Grenada Bank Blind Snake (*Typhlops tasymicris*) was known previously from only two individuals collected on Grenada in 1968.

(Henderson and Powell 2006), probably with shipments of gravel or sand used in road construction. Found on Union under rocks in moist, loose soil along rock ledges in shade (J. Boone in Henderson and Powell 2009). Their small size and secretive nature renders these snakes inconspicuous and difficult to detect. They feed primarily on small invertebrates (Boos 2001). Although probably no threat to other snakes on Union, if *T. melanocephala* populations increase significantly, they could compete with insectivorous lizards (Berg et al. 2009).

Typhlops tasymicris (Thomas 1974). Family Typhlopidae. Local name: N/A (newly discovered on Union). English common name: Grenada Bank Blind Snake. Little is known about this Grenada Bank endemic (Germano et al. 2003, Yorks et al. 2003b). Until rediscovered on Union in 2010 (Rivera Rodríguez et al., in press-b), only two subadult females caught in 1968 on Grenada were known to science. All Union Island snakes were under cover in moist substrate on the slopes above Chatham Bay. Two were found under deep leaf litter, two (including an individual that escaped) under rocks, and one under a termite mound. These fossorial snakes have blunt heads with eyes covered by scales, hence the common name. A spike at the end of the very short tail is used as an anchor in burrowing. The overall appearance is very similar to an earthworm, with which Blind Snakes are often confused.

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