Cantaurus, Vol. 20, 31-35, May 2012 © McPherson College Division of Science and Technology

A Rapid Assessment of Reptilian Diversity on Union Island, St. Vincent, and the Grenadines

Audrey L. McTaggart, Daniel P. Quinn, John S. Parmerlee, Jr., Robert W. Henderson, and Robert Powell

ABSTRACT

Union Island, St. Vincent and the Grenadines (8.4 km^2) has an unusually diverse reptilian fauna for such a small area, but lacks native or well-established introduced amphibians. In June 2010, we conducted a rapid assessment of 10 sites (coastal or with some variation of dry forest habitats) chosen on the basis of vegetative complexity, height and extent of canopy, and degree of human disturbance. We encountered 10 of the 15 species recorded from Union, missing only a few secretive litter-dwelling or fossorial forms and a recently introduced species for which the current status is unknown. Shannon diversity indices were negatively correlated with vegetative complexity, but the density of *Anolis aeneus*, the most frequently encountered species, was positively correlated with complexity.

Keywords: *Anolis aeneus, Chatham Bay, Corallus grenadensis, Grenada Bank, reptiles, secondary forest, survey, Union Island, vegetative complexity.*

INTRODUCTION

Herpetological fieldwork has been ongoing in the West Indies for more than 300 years, with most efforts devoted to collecting specimens in order to document what species occur on which islands and to describe new species (*e.g.,* Powell and Henderson, 1996; Williams,1999). The past 100 years have been especially fruitful in accumulating herpetological material, with the past 50-60 years particularly intense for the collecting and describing of new taxa in the region. The 1960s, however, also saw a growing interest in the ecology and behavior of the West Indian herpetofauna, especially lizards of the genus *Anolis,* and the past 30 years have witnessed efforts to study various aspects of the natural history of all groups of West Indian herpetofauna (Henderson and Powell, 2009). Nevertheless, much remains to be learned regarding all facets of Antillean herpetology. New species are being discovered and described with astonishing regularity (Hedges, 2006). Henderson and Powell (2009) determined that fewer than 5% of the more than 700 known Antillean herpetofauna have been the focus of prolonged field studies.

Although the large islands of the Greater Antilles continue to be the source of most new species discoveries and also are the setting of many ecology-oriented projects, much smaller islands (*e.g.,* British Virgin Islands, Lesser Antilles) have revealed new species (*e.g.,* Mayer and Lazell, 2000; Powell and Henderson, 2005) and have provided the locations for many ecological and behavioral studies (*e.g.,* Lazell, 2005). Over the past decade, rapid assessment surveys (which combine efforts to document species occurrence in a variety of habitats, ecology, and the impact of human activity) have been conducted on major islands (311-790 km^2) in the Lesser Antilles (Germano *et al.,* 2003; Mallery *et al.,* 2007; Ackley *et al.,* 2009); here, we focus on a similar assessment, but on a much smaller island.

Union Island (*ca.* 8.4 km^2 and with a maximum elevation of 330 m) is centrally located among the Grenadine Islands that lie between St. Vincent to the north and Grenada to the south, and it occupies the same island bank as Grenada. It is characterized by seasonal dry forest habitat (Fiard, 2003) that has seen dramatic transformations in the past (Wilson *et al.,* 2006). Average annual precipitation is 100 cm (Adams, 1979). Amerindian tribes are thought to have settled on Union about 5000 BC and were present until the mid-18th century when the first Europeans arrived (Newsom and Wing, 2004). Over the next 150-200 years, nearly all of Union's forests were clear-cut for extensive monocultures (*e.g.,* cotton; Howard, 1952). Due to the combination of low rainfall and a long history of human disturbance, much of Union's remaining woodlands are classified as dry, secondary forest (Fiard, 2003).

Fifteen extant reptilian species are known to occur on Union (Quinn *et al.,* 2010). During June 2010, we conducted a rapid assessment of reptilian communities to determine the diversity and relative abundance of reptiles in relation to the vegetative complexity of habitats, most consisting of coastal habitats or variations of dry forest.

MATERIALS AND METHODS

From 6–20 June 2010 we surveyed 10 herpetofaunal communities throughout Union Island (Figure 1). Sites were chosen based on vegetative characteristics, elevation, and the extent of human disturbance (Table 1).

Vegetative complexity ranks were assigned

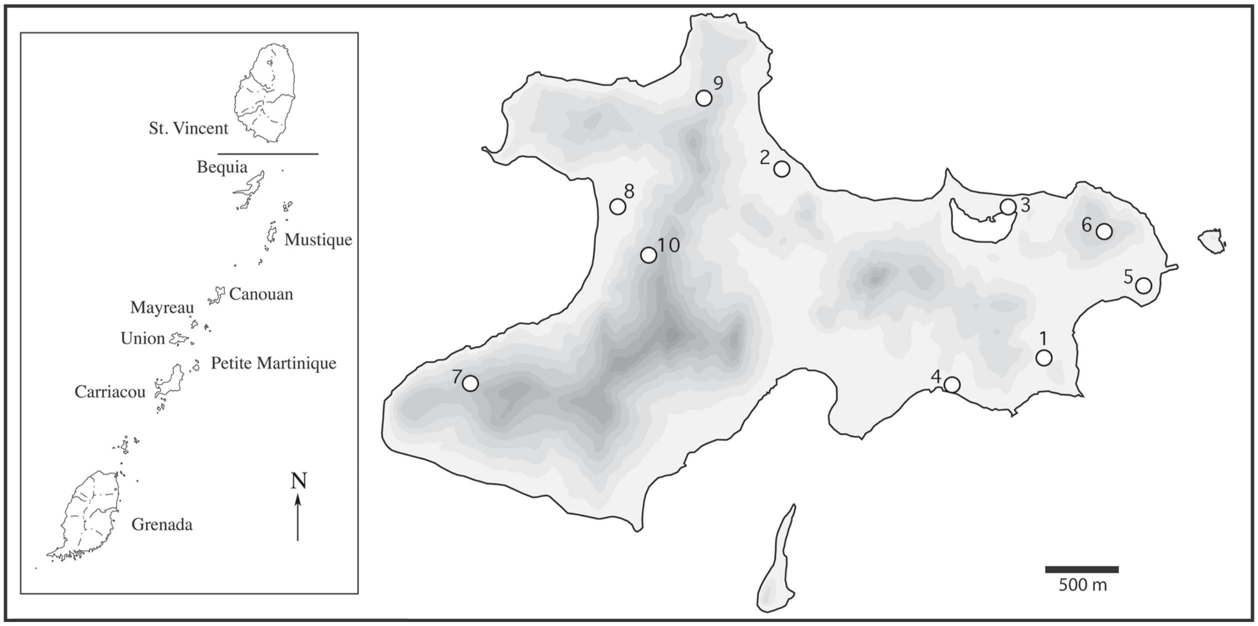

Figure 1. Union Island showing sites where rapid assessments were conducted. Numbers reflect vegetative complexity (see text), with 10 indicating the greatest complexity and 1 the least. Contour interval = 100 ft (30.5 m). The horizontal line on the insert map indicates the boundary between the Grenada Bank to the south and the St. Vincent Bank to the north.

according to the number and variety of trees, height and continuity of the crown, and degree of human disturbance. Ranks ranging from 1 (least complex) to 10 (most complex) also were used to identify sites. GPS coordinates are reported in degrees (◦) and decimal minutes (‘) (DDD◦mm.mmm’) as described in the WGS 1984 datum. Elevations of 1–5 m above sea level (ASL) were visually estimated. A Garmin etrex H (Garmin Ltd., Olathe, Kansas) was used to determine higher elevations. Weather and litter depth were recorded when transects and plots were surveyed.

At each site, we conducted visual encounter surveys as in Ackley et al. (2009). Two people, walking approximately 100 m every 30 min, examined each transect twice, once in the morning (0800–1130 h) and again at night (2000–2330 h). Reptiles encountered within 2 m on either side of the transect and at any height were counted. Distances were measured using a transect tape, except in the urban site (Site 1), where we used a Bosch Digital Laser Distance Meter (Robert Bosch GmbH, Stuttgart, Germany).

Individual site transects were either 50 × 4 m, 100 × 4 m, or 200 × 4 m, depending on the limitations imposed by topography and the extent of vegetative types. When running transects in the urban site, the search for reptiles started 1 m from the edge of the road (or sidewalk, when present).

For litter-dwelling species that might not otherwise be seen, we examined 2 × 2-m plots by day and by night for every 50 m of transect. Plots were adjacent to but not overlapping with transects. Animals encountered while outlining a plot were counted along with those found while sifting through litter or searching under cover. Two sites (1 and 2) precluded the use of plots due to lack of leaf and bark litter. Scarcity of litter at Site 6 allowed for only one plot to be examined.

Diversity at each site was calculated using the Shannon diversity index ($H = -\sum_{i-1}^{s} p_i \ln(p_i)$), which takes into account species richness and evenness (Stirling and Wilsey, 2001). Because we found only one species at sites 3 and 5, the Shannon diversity index could not be applied. Anole densities were calculated by dividing the number of anoles per site by the total area of transects at that site. We used a Kendall Rank Correlation (α = 0.05) to relate vegetative complexity to species richness and diversity.

RESULTS

During the rapid assessment, we encountered 10 of the 15 reptilian species known to occur on the island (Table 2). We did not encounter *Bachia heteropa* (Gymnophthalmidae), *Gonatodes daudini* and *Sphaerodactylus kirbyi* (Sphaerodactylidae), or *Typhlops tasymicris* (Typhlopidae), all small and inconspicuous litter- and crevice-dwelling species that are known to occur on the slopes above Chatham Bay (Site 10). We also failed to encounter

Tantilla melanocephala, a recently introduced South

Table 1. Sites surveyed in the rapid assessment of reptilian communities on Union Island, St. Vincent and the Grenadines. Predominant species at each site are listed below the table. Site numbers correspond to vegetative complexity rank.

Site	Description	GPS Coordinates	Elevation (m ASL)	Canopy Cover (%)	Canopy Height (m)	Understory Height (m)	Leaf Litter Depth (cm)	Other
1	Urban	N12° 35.699' W61°25.155'	2	-	-	-	-	Concrete buildings 1-3 stories high; buildings spaced 1 m apart; constant vehicular and human traffic; some decorative landscaping between buildings.
2	Acacia Flats	N12°36.342' W61°26.055'	1	20	3-5	-	-	Grove flooded after heavy rain.
3	Mangrove	N12°36.089' W61°25.309'	1-2	80+	5-7	-	1.7	Transects along a dirt road with occasional vehicular traffic.
4	Manchineel	N12°35.541' W61°25.470'	1	40-60	8-10	-	2.8	Evidence of human disturbance within the grove; debris and other litter found within the transect.
5	Coastal Cocos/ Thorny Scrub	N12°35.538' W61°24.456'	1-2	Co.=20 Sc.=60-80	Co.=25-30 Sc.=2-3	-	4	Transect between a small hillock with thorny scrub and a sandy coastal environment.
6	Windswept Dry Forest	N12°36.120' W61°24.929'	126	20-40	2-4	<1	-	Transect held at a dilapidated tourist site; some man-made structures were grown over with weeds and grass; no other persons encountered.
7	Transitional Dry Forest/ Scrub	N12°35.336' W61°27.232'	144-154	20-40	3-5	1-3	1.6	Transect on narrow, rocky, moderately steep path; no other persons encountered.
8	Coastal Dry Forest	N12°36.225' W61°26.777'	2-10	40-60	8-12	1-2	2	Transect on an unpaved road with occasional vehicular traffic.
9	Dry Scrub Forest	N12°36.392' W61°26.245'	39-59	60-80	4-6	1-2	1.8	Transect on a dirt trail with moderate human traffic.
10	Secondary Dry Forest	N12°36.169' W61°26.591'	123-155	60-80	10-20	1-2	2	Transects on narrow, dirt trail; no other persons encountered.

American species (Henderson and Powell, 2006;

Table 2. Reptiles surveyed at study sites on Union Island. Dashes indicate that no individuals were recorded at that site.

Family and Species	Sites										Total Individuals
	1	2	3	4	5	6	7	8	9	10	
Family Polychrotidae *Anolis aeneus*	5	2	-	16	-	3	6	19	13	62	126
Family Teiidae *Ameiva ameiva tobagana*	-	4	2	-	8	7	-	-	-	-	21
Family Iguanidae *Iguana iguana*	-	-	-	-	-	-	-	-	-	1	1
Family Scincidae *Mabuya mabouya*	-	-	-	-	-	-	1	-	-	1	2
Family Gekkonidae *Hemidactylus mabouia*	-	-	-	-	4	1	-	-	-	-	5
Family Phyllodactulidae *Thecadactylus rapicauda*	-	1	-	5	-	-	-	-	-	-	6
Family Gymnophthalmidae *Gymnophthalmus underwoodi*	-	-	-	4	2	-	-	-	-	-	6
Family Boidae *Corallus grenadensis*	-	-	-	-	-	-	-	-	3	1	4
Family Colubridae *Mastigodryas bruesi*	-	-	-	-	-	-	-	-	1	1	2
Family Testudines *Chelonoides carbonaria*	-	-	-	-	-	-	-	1	-	-	1
Total Individuals	5	7	2	25	14	11	7	20	17	66	174
Species Richness	1	3	1	3	3	3	2	2	3	5	

Berg et al., 2009), the current status of which is unknown. Although the introduced frog, *Eleutherodactylus johnstonei*, was heard calling on two different occasions at low elevations on the island, it was never observed.

Of the 174 observations on Union, 126 were of *Anolis aeneus*, which we found in all but two of the survey sites. Vegetative complexity was negatively correlated with diversity indices (Kendall correlation, Z = – 2.39; P = 0.02), but positively correlated with anole density (Z = 2.17; P = 0.03).

DISCUSSION

Primarily because of its small size and uniformly xeric conditions, the herpetofauna of Union Island is relatively sparse when compared to larger Lesser Antillean islands where similar surveys have been performed (Dominica [Ackley *et al.*, 2009]; Grenada [Germano *et al.*, 2003]; St. Vincent [Mallery *et al.*, 2007]). Although reptilian species richness is comparable in all instances, Union lacks amphibians, which comprised substantial percentages of individuals encountered during surveys on the larger island. We used the species-area curve (Macarthur and Wilson, 1967) to compare and evaluate herpetofaunal diversity between these four islands. We observed the general trend that larger islands, closer to the mainland, have a greater species richness. However, our low amount of data precludes us from making a definite positive or negative correlation with the species-area curve.

Despite recent efforts (*e.g.,* Daudin and de Silva, 2007; Quinn *et al.,* 2010), Union and the Grenadines in general remain poorly known herpetologically, and we consider the herpetofauna on Union to be in flux with taxa new to the island being discovered during almost every visit. We therefore felt it premature to attempt any species richness assessments at this time.

Although we found more individuals at sites with greater vegetative complexity, the species evenness of those sites was low, largely due to the numerical dominance of anoles. As diversity indices consider both species richness and evenness (Stirling and Wilsey, 2001), the diversity at those sites was low—accounting for the negative correlation between complexity and diversity. *Anolis aeneus* was ubiquitous on Union and was present in all but two sites (3 and 5; it was, however, encountered off transects and out of plots at those sites as well). The positive correlation between anoline density and vegetative complexity also might have influenced the negative correlation between complexity and diversity indices.

ACKNOWLEDGEMENTS

Amos Glasgow, Department of Forestry, St. Vincent and the Grenadines, and Mark de Silva identified vegetation. Tess Bellah, Ehren J. Bentz, Rebecca R. John, and Mel J. Rivera helped in the field. Permits to conduct research on Union Island were issued by Mr. Brian Johnson, Director, Department of Forestry, St. Vincent and the Grenadines. Protocols were approved by the Avila University Animal Care and Use Committee. Fieldwork was funded by a grant from the National Science Foundation (USA) to Robert Powell (DBI-0851610).

LITERATURE CITED

Adams, J. E. 1979. Union Island, West Indies: An historical and geographic sketch. Caribbean Studies, 15:5-45.

Ackley, J. W., P. J. Muelleman, R. E. Carter, R. W. Henderson, and R. Powell. 2009. A rapid assessment of herpetofaunal diversity in variously altered habitats on Dominica. Applied Herpetology, 6:171-184.

Berg, C. S., A. Jeremiah, B. Harrison, and R. W. Henderson. 2009. New island records for *Tantilla melanocephala* (Squamata: Colubridae) on the Grenada Bank. Applied Herpetology, 6:403-404.

Daudin, J., and M. de Silva. 2007. An annotated checklist of the amphibians and terrestrial reptiles of the Grenadines with notes on their local natural history and conservation. *Applied Herpetology,* 4:163‑175.

Fiard, J.-P. 2003. The phytosociologic and dynamic outline of the main forestry groups of Union Island; pp. 47-53. In: J. Daudin (Ed.), A Natural History Monograph of Union Island. Désormeaux, Martinique, French West Indies.

Germano, J. M., J. M. Sander, R. W. Henderson, and R. Powell. 2003. Herpetofaunal communities in Grenada: A comparison of altered sites, with an annotated checklist of Grenadian amphibians and reptiles. Caribbean Journal of Science, 39:68-76.

Hedges, S. B. 2006. An overview of the evolution and conservation of West Indian amphibians and reptiles. Applied Herpetology, 3:281-292.

Henderson, R. W., and R. Powell. 2006. Geographic distribution: *Tantilla melanocephala* (NCN). Herpetological Review, 3:501.

Henderson, R. W., and R. Powell. 2009. Natural History of West Indian Reptiles and Amphibians. University Press of Florida, Gainesville, xxiv + 496 pp.

Howard, R. A. 1952. The vegetation of The Grenadines, Windward Islands, British West Indies. Contributions from the Gray Herbarium of Harvard University, 174:1-129.

Lazell, J. 2005. Island: Fact and Theory in Nature. University of California Press, Berkeley, 382 pp.

Macarthur, R. H., and E. O. Wilson. The theory of island biogeography. 1st ed. New Jersey: Princeton University Press; 1967

Mallery, C. S., M. A. Marcum, R. Powell, J. S. Parmerlee, Jr., and R. W. Henderson. 2007. Herpetofaunal communities of the leeward slopes and coasts of St. Vincent: A comparison of sites variously altered by human activity. Applied Herpetology, 4:313-325.

Mayer, G. C., and J. D. Lazell. 2000. A new species of *Mabuya* (Sauria: Scincidae) from the British Virgin Islands. Proceedings of the Biological Society of Washington, 113:871-886.

Newsom, L.A., and E.S. Wing. 2004. On Land and Sea: Native American Uses of Biological Resources in the West Indies. University of Alabama Press, Tuscaloosa. 272 pp.

Powell, R., and R. W. Henderson. 1996. A brief history of West Indian herpetology; pp. 29-50. In: R. Powell and R.W. Henderson (Eds.), Contributions to West Indian Herpetology: A Tribute to Albert Schwartz. Society for the Study of Amphibians and Reptiles, Contributions to Herpetology, Volume 12. Ithaca, New York.

Powell, R., and R. W. Henderson. 2005. A new species of *Gonatodes* (Squamata: Gekkonidae) from the West Indies. Caribbean Journal of Science, 41:709-715.

Quinn, D. P., A. L. McTaggart, T. A. Bellah, E. J. Bentz, L. G. Chambers, H. D. Hedman, R. R. John, D. N. Muñiz Pagan, and M. J. Rivera Rodríguez. 2010. The reptiles of Union Island, St. Vincent and the Grenadines. Reptiles & Amphibians, 17:222-233.

Stirling, G., and B. Wilsey. 2001. Empirical relationships between species richness, evenness, and proportional diversity. The American Naturalist, 3:286-299.

Williams, E. E. 1999. Over 300 years of collecting in the Caribbean; pp. 1-30. In: B.I. Crother (Ed.), Caribbean Amphibians and Reptiles. Academic Press, San Diego, California.

Wilson, B. S., J. A. Horrocks, and A. Hailey. 2006. Conservation of insular herpetofaunas in the West Indies. Applied Herpetology, 3:181-195.