

A Rapid Inventory of Amphibians, Squamates, and Bats of Mata de Plátano Field Station and Nature Reserve, Arecibo, Puerto Rico

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Abstract

Puerto Rico harbors a diverse vertebrate fauna with high levels of endemism. However, while several books for vertebrate diversity and local checklists for birds have been published, checklists of amphibians, reptiles, and bats are lacking or nonexistent at both local and regional scales. In this study, we documented the amphibian, reptile, and bat faunas at Mata de Plátano Field Station and Nature Reserve, in Arecibo, Puerto Rico. We document four species of amphibians, seven lizards, three snakes, and nine bats. Despite prior works using samples from this nature reserve, this represents the first vertebrate checklist for the Mata de Plátano Field Station and Nature Reserve. We provide additional natural history observations based on our survey results and highlight the importance of including local and regional checklists of species for downstream research and conservation.

A Rapid Inventory of Amphibians, Squamates, and Bats of Mata de Plátano Field Station and Nature Reserve, Arecibo, Puerto Rico

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Abstract

Puerto Rico harbors a diverse vertebrate fauna with high levels of endemism. However, while several books for vertebrate diversity and local checklists for birds have been published, checklists of amphibians, reptiles, and bats are lacking or nonexistent at both local and regional scales. In this study, we documented the amphibian, reptile, and bat faunas at Mata de Plátano Field Station and Nature Reserve, in Arecibo, Puerto Rico. We document four species of amphibians, seven lizards, three snakes, and nine bats. Despite prior works using samples from this nature reserve, this represents the first vertebrate checklist for the Mata de Plátano Field Station and Nature Reserve. We provide additional natural history observations based on our survey results and highlight the importance of including local and regional checklists of species for downstream research and conservation.

Keywords

Bats, Caves, Frogs, Lizards, Karst, Snakes, Tropical moist forest

Introduction

Puerto Rico is an island of the Greater Antilles comprising ~ 9100 km², and located at 18.2° N, 66.6° W between the Virgin Islands and Hispaniola. The island constitutes a small archipelago of over 125 islands and cays that are geologically complex. About 28% of the terrain of the main island of Puerto Rico is covered in limestone cliffs, valleys, and hills with a dichotomy between mesic and xeric forests in the northern and southern regions, respectively (Monroe 1976; Lugo et al. 2001). The heterogeneity of Puerto Rico's landscape and habitats harbor diverse vertebrate fauna, especially in areas associated with forests and karst formations. Among the focal taxa in this study, the diversity of this island includes a total of 18 amphibians, 72 squamates (lizards and snakes) (Rivero 1998; Uetz et al. 2023) and 13 bats (Gannon et al. 2005). For the herpetofauna, about 60 species (43%) are endemic to Puerto Rico; out of the bat species, 2 (15%) and 6 (46%) are locally endemic to Puerto Rico and regionally endemic to the West Indies, respectively. The bats and herpetofauna of Puerto Rico are continuously being studied and have served as models for studying natural disaster effects on island ecosystems (Calderón-Acevedo et al. 2021), hybridization and sex chromosome research (Pinto et al. 2019, 2022), and niche partitioning genome-environmental association studies (Wogan et al. 2020; Ingram et al. 2022). Nonetheless, distribution and taxonomic accounts of these taxa in locally protected habitats and preserves are generally lacking. Checklists at local and island-wide scales for Puerto Rico are limited to algae (Ballantine and Aponte 1997), insects (Ramírez et al. 2020), birds (Arendt et al. 2015), and arthropods (Vélez Jr. Jr. 1967; Pérez-Reyes et al. 2013; Ospina-Sánchez et al. 2020), but are lacking for bats, squamates, and amphibians. The need for more regional and up-to-date checklists in Puerto Rico is important for biogeographic, evolutionary, and conservation studies, as many taxa have restricted ranges and are isolated to regional caves and/or forests (Rivero 1998; Kurta and Rodríguez-Durán 2005). Here, we provide the first faunal checklist for Mata de Plátano Field Station and Nature Reserve (collectively referred to as Mata de Plátano here), an area in the north-central subtropical moist forests of Arecibo that contains multiple caves, including Cueva de los Culebrones, a cave system well-known for the predator-prey interactions between the endemic boa (*Chilabothrus inornatus*) and several bat species.

Study Area

Mata de Plátano consists of a 53-hectare, protected nature reserve, about 7 km southwest of the city of Arecibo. It is located in the northern karst belt region of Puerto Rico (18.414, -66.729) at 151 m above sea level (Figure 1). The reserve is part of the largest unfragmented and species rich forests of Puerto Rico. The sub-tropical moist forested areas of the reserve consist of a few undisturbed areas amongst different successional stages of other forests. These areas have canopies up to ~ 20 m that receive precipitation that ranges from 100–220 cm per year, with dry months being from December–March, and wet months from April–November (Ewel and Whitmore 1973). The study area in this checklist includes two cave systems: Cueva Larvas (18.414° N, -66.727° W) and Cueva de los Culebrones (18.414° N, 66.725° W). Cueva Larvas

is a small cave with a wide entrance, while Cueva de los Culebrones is a 182-meter (m) long hot cave with an entrance that is 5 x 3 x 8 (width x height x depth, m; Puente-Rolón 1999).

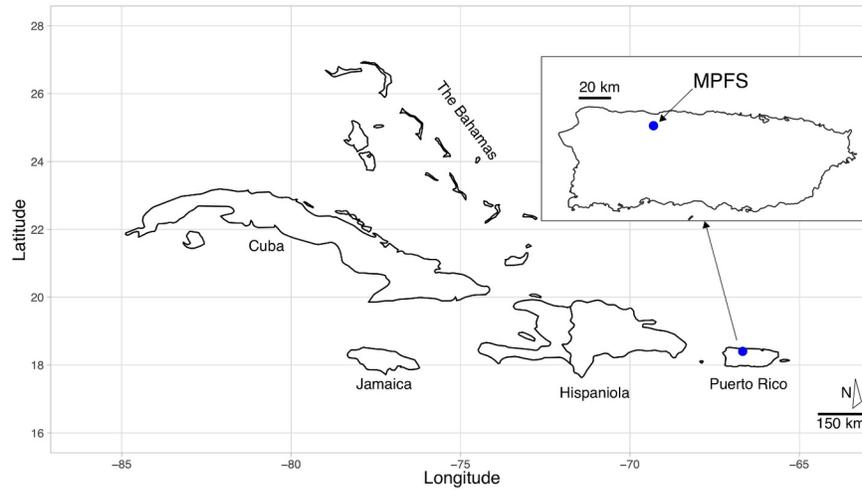


Figure 1. Map of Puerto Rico, with Arcibo shaded in yellow. The blue dots represent the location of Mata de Plátano Field Station.

Methods

Herpetofauna —. Field surveying was conducted from 1–9 June 2022. Opportunistic sampling was performed to find lizards and snakes under logs, rocks, in leaf litter, on trees, and throughout cave systems. Non-protected species were caught by hand, while taxa that are protected and listed as endangered by U.S. Fish & Wildlife Service (see *Results*) were identified with photo vouchers and observed from a distance. Photographs were taken with a Nikon 70D DSLR camera with a Tamron AF 90 mm macro lens. Species identification was done using morphological criteria from (Rivero 1998). No specimens were collected but were easily identifiable based on distinguishing morphology from syntopic taxa.

Bat fauna —. Field surveys for bats were conducted during 1–9 June 2022. Bats were captured in mist nets (6–9 m long by 3 m high, Avinet 38mm mesh) set along forest corridors near the field station. Captured bats were identified to species and standard measurements (i.e., forearm and weight) were taken. Photographs were taken with a Nikon 70D DSLR camera with a Tamron AF 90 mm macro lens and with a Cannon G12. No specimens were collected during surveys and all individuals were released at the site of capture. This study was conducted following the Departamento de Recursos Naturales de Puerto Rico (permit no. 2022-IC-034 issued to JASC) and under compliance with Rutgers IACUC (permit no. 201900087 issued to JASC). Coordinates for sites of capture were taken with a Garmin GPSMap 65 series to the nearest 0.00001 degree.

Results

During our field work we found a total of 14 species of herpetofauna (four amphibians, seven lizards, three snakes) and 8 species of bats. We list our inventory of amphibians, reptiles, and bats below.

Amphibians

Family Bufonidae

Rhinella marina (Linnaeus, 1758)

Figure 2A

Materials examined. PUERTO RICO – **Arecibo** * Mata de Platano Field Station and Nature Reserve; 18.414, -66.729; 151 m above sea level; Justin Matthew Bernstein, Camilo Andres Calderon-Acevedo, Pedro Ivo Monico, Lazaro Willian Vinola-Lopez, J. Angel Soto-Centeno; Individual 1 – found in leaf litter on south side of field station at 11:30 PM.

Identification. One adult individual, diagnosed by its large size, enlarged parotid glands, and drier, warty skin distinguish this amphibian from all others on the island. It is easily distinguished from *Peltophryne lemur* by its shorter rostrum that is not upturned.

Family Eleutherodactylidae

Eleutherodactylus coqui Thomas, 1966

Figure 2B

Materials examined. PUERTO RICO – **Arecibo** * Mata de Platano Field Station and Nature Reserve; 18.414, -66.729; 151 m above sea level; Justin Matthew Bernstein, Camilo Andres Calderon-Acevedo, Pedro Ivo Monico, Lazaro Willian Vinola-Lopez, J. Angel Soto-Centeno; Individual 1 – found in leaf litter on west side of field station at 6:00 PM; Individual 2 – found on east wall of field station at 9:30 PM; Individual 3 – found in leaf litter at far end of open field 73 m south of field station.

Identification. Three adults, identified by a combination of morphology and geographic distribution. Diagnosed by eye color (tan/brown) and color pattern (no dorsal stripe, saddle pattern on back and dorsolateral lines). *Eleutherodactylus monensis*, *E. cooki*, *E. cochranae*, *E. portoricensis*, *E. karlschmidti*, *E. gryllus*, *E. locustus*, *E. wightmanae*, *E. eneidae*, *E. richmondi*, *E. unicolori*, and *E. jasperi* are all outside the range of our study area. *Eleutherodactylus brittoni* found in meadows and has a narrow black streak at the tip of the snout, stretching and continuing along the flanks (absent in our observed individuals). *Eleutherodactylus portoricensis* has silver or chalky white eyes (tan/brown eyes in our individuals) and restricted to mountains. *Eleutherodactylus hedricki* has a pronounced constriction behind the head and a shallow furrow on the middle of the back from the head to the sacrum (absent in our individuals). *Eleutherodactylus richmondi* has yellow or white lines on each side of the head, that range from the tip of the snout to near the vent (absent in our individuals). *Eleutherodactylus antillensis* has a dorsal stripe that stretches from the tip of the snout to the vent (absent in our individuals) and reddish eyes (tan/brown in our individuals).

Eleutherodactylus antillensis (Reinhardt & Lutken, 1863)

Figure 2C

Materials examined. PUERTO RICO – **Arecibo** * Mata de Platano Field Station and Nature Reserve; 18.414, -66.729; 151 m above sea level; Justin Matthew Bernstein, Camilo Andres Calderon-Acevedo, Pedro Ivo Monico, Lazaro Willian Vinola-Lopez, J. Angel Soto-Centeno; Individual 1 – found in leaf litter near entrance of open field, 73 m south of field station; Individual 2 – caught in mist net placed at path of open field 75 m south of field station 7:40 PM.

Identification. Two adults, identified by a combination of morphology and geographic distribution; diagnosed by its thin, mid-dorsal stripe on the head and body, and reddish eyes. Similar to the identification of *E. coqui*, *E. monensis*, *E. cooki*, *E. cochranae*, *E. portoricensis*, *E. karlschmidti*, *E. gryllus*, *E. locustus*, *E. wightmanae*, *E. eneidae*, *E. richmondi*, *E. unicolori*, and *E. jasperi* are all outside the range of our study area. *Eleutherodactylus brittoni* found in meadows and has a narrow black streak at the tip of the snout, stretching and continuing along the flanks (absent in our observed individuals). *Eleutherodactylus portoricensis* has silver or chalky white eyes (tan/brown eyes in our individuals) and restricted to mountains. *Eleutherodactylus hedricki* has a pronounced constriction behind the head and a shallow furrow on the middle of the back from the head to the sacrum (absent in our individuals). *Eleutherodactylus richmondi* has yellow or white lines on each side of the head, that range from the tip of the snout to near the vent (absent in our individuals). *Eleutherodactylus coqui* may or may not have the dorsal stripe that stretches from the tip of the snout to the vent that is seen in *E. antillensis*, *E. coqui* has tan/brown eyes (reddish in our individuals).

Eleutherodactylus cochranae Grant, 1932

Figure 2D

Materials examined. PUERTO RICO – **Arecibo** * Mata de Platano Field Station and Nature Reserve; 18.414, -66.729; 151 m above sea level; Justin Matthew Bernstein, Camilo Andres Calderon-Acevedo, Pedro Ivo Monico, Lazaro Willian Vinola-Lopez, J. Angel Soto-Centeno; Individual 1 – found on east wall of field station at 9:10 PM.

Identification. One adult. Identified by its light coloration, two concave dorsal pigmentation lines, and a faint line of pigmentation in the middle of the snout.



Figure 2. Frogs found at the Mata de Plátano Field Station and Nature Reserve. **A.** *Rhinella marina* . **B.** *Eleutherodactylus coqui* . **C.** *Eleutherodactylus antillensis* . **D.** *Eleutherodactylus cochranae* . All photographs taken by Justin M. Bernstein.

Lizards

Family Dactyloidae

Anolis cristatellus Duméril & Bibron, 1837

Figure 3A

Materials examined. PUERTO RICO – **Arecibo** * Mata de Platano Field Station and Nature Reserve; 18.414, -66.729; 151 m above sea level; Justin Matthew Bernstein, Camilo Andres Calderon-Acevedo, Pedro Ivo Monico, Lazaro Willian Vinola-Lopez, J. Angel Soto-Centeno; Individual 1 – found on karst wall on southwest side of field station at 6:00 PM; Individual 2–3 – found on karst wall next to steel entrance gate of field station, 138 m southwest of field station building at 6:00 PM; Individuals 4–5 – on walls, beneath second-level deck of field station at 8:23 AM; Individual 6 – Outside the entrance of Cueva Larvas (18.414deg N, -66.727degW) in forest with cooler microclimate, found on vines with spotty sunlight, at 12:25 PM; Individuals 8 – on palm tree at ~ 1.5 m off ground at 8:00 AM, performing territorial ‘push up’ behavior;

Individuals 9–10 – on south wall of field station mating with each other at 4:58 PM; Individuals 11–13 – sleeping on plants on forest edge on south side of field station at 12:30 AM; Individuals 14–17: found on plants on forest edge on south side of field station at 8:00 AM; Individuals 18–19 on branches ~1.5 m above ground, near karst wall on southwest side of field station at 2:45 PM; Individual 20 – in forest on leaf litter, ~50 m south of Cueva de los Culebrones.

Identification. Identified based on morphology and geographic distribution. The brown/tan and coloration, brown eyes, and crest of this species distinguishes it from all other *Anolis* in Puerto Rico. *Anolis evermanni* has green coloration, and *A. stratulus* has large, dorsal, saddle-shaped blotches on the back distinguished. *Anolis gundlachi* has blue eyes, *A. krugi* has yellow or cream-colored lateral stripes (absent in our individuals), and *A. cuvieri* is a large, green crown giant anole. All other *Anolis* are found outside the range of Mata de Platano.

Anolis cuvieri Merrem, 1820

Figure 3B

Materials examined. PUERTO RICO – **Arecibo** * Mata de Platano Field Station and Nature Reserve; 18.414, -66.729; 151 m above sea level; Justin Matthew Bernstein, Camilo Andres Calderon-Acevedo, Pedro Ivo Monico, Lazaro Willian Vinola-Lopez, J. Angel Soto-Centeno; Individual 1 – found sleeping on U-shaped vine ~ 4.5 m above ground at southeast edge of field station at 9:00 PM.

Identification. This species is readily distinguished from all congeners by being one of two crown giant anoles in the Puerto Rico Bank. It's bright green coloration, large dorsal body and tail crests, and large size (~125 mm; 5 mm snout-vent-length; Rivero 1998) separate it from all other *Anolis*. The other crown giant, *A. roosevelti*, was distributed to the Puerto Rico satellite islands of Culebra and Vieques, and Tortola and St. John of the Virgin Islands, but is presumed to be extinct (Rivero, 1998).

Anolis krugi PETERS, 1877

Figure 3C

Materials examined. PUERTO RICO – **Arecibo** * Mata de Platano Field Station and Nature Reserve; 18.414, -66.729; 151 m above sea level; Justin Matthew Bernstein, Camilo Andres Calderon-Acevedo, Pedro Ivo Monico, Lazaro Willian Vinola-Lopez, J. Angel Soto-Centeno; Individual 1–2 – found on plants on forest edge on south side of field station at 5:00 PM; Individual 3 – on branch ~1.5 m above ground, over karst wall on southwest side of field station at 3:00 PM; Individual 4 – on branch ~1.7 m above ground on forest edge ~50 m south of field station; Individual 5 – in forest on ground, ~50 m south of Cueva de los Culebrones.

Identification. Distinguished from all other species by a combination of the presence of prominent yellow/cream-colored lateral lines that extend from the eye to the groin (also found in *A. pulchellus*) and numerous black specks on the sides of the back and flanks (absent in *A. pulchellus*), and the absence of a brown band behind the eye. All other *Anolis* are found outside the range of Mata de Platano or lack the lateral lines and black specks on the back and flanks.

Anolis stratulus Cope, 1861

Figure 3D

Materials examined. PUERTO RICO – **Arecibo** * Mata de Platano Field Station and Nature Reserve; 18.414, -66.729; 151 m above sea level; Justin Matthew Bernstein, Camilo Andres Calderon-Acevedo, Pedro Ivo Monico, Lazaro Willian Vinola-Lopez, J. Angel Soto-Centeno; Individual 1 – On south wall of field station at 11:00 AM; Individuals 2–3 – found on karst wall on southwest side of field station at 8:23 AM; Individuals 4–6 – found on karst wall on southwest side of field station 11:07 AM; Individuals 7–8 – sleeping on plants on forest edge on south side of field station at 12:30 AM.

Identification. Readily identified from all other *Anolis* on the island by the prominent saddle-shaped blotched on the dorsum. The lack of a crest on the dorsum or tail distinguish it from all other Puerto Rican

anoles, with the exception of *A. evermanni* and *A. occultus*. *Anolis evermanni* has bright green coloration (tan/brown in our individuals) and *A. occultus* has a downward tapering snout and a smaller body size and tail than *A. stratulus*; both *A. evermanni* and *A. occultus* lack saddle-shaped blotches on the dorsum.

Family Teiidae

Pholidoscelis exsul (Cope, 1862)

Materials examined. PUERTO RICO – **Arecibo** * Mata de Platano Field Station and Nature Reserve; 18.414, -66.729; 151 m above sea level; Justin Matthew Bernstein, Camilo Andres Calderon-Acevedo, Pedro Ivo Monico, Lazaro Willian Vinola-Lopez, J. Angel Soto-Centeno; Individual 1–2 – on ground of trail ~6m south of field station at 8:40 AM; Individua 3 – on ground of trail ~ 15 m south of field station.

Identification. *Pholidoscelis exsul* is one of few teiid lizards found on Puerto Rico. It is distinguished from its island conspecifics by a combination of morphology (color pattern), but is primarily identified by geographic distribution. *Pholidoscelis wetmorei* is only found in the southwest part of the island, *P. alboguttatus* is endemic to Mona Island, and *P. desecheensis* endemic to Desecheo Island.

Family Sphaerodactylidae

Sphaerodactylus grandisquamis guarionex Stejneger, 1904

Figure 3E

Materials examined. PUERTO RICO – **Arecibo** * Mata de Platano Field Station and Nature Reserve; 18.414, -66.729; 151 m above sea level; Justin Matthew Bernstein, Camilo Andres Calderon-Acevedo, Pedro Ivo Monico, Lazaro Willian Vinola-Lopez, J. Angel Soto-Centeno; Individual 1 – under palm trash on side of trail ~ 15 m south of field station at 10:30 PM; Individual 2 – under palm trash on side of trail ~15 m south of field station at ~8:30 AM; Individual 3 – found on top of leaf litter in open field 75 m south of field station at 6:20 PM; Individuals 4–10 – found on top of leaf litter in open field 85 m south of field station at 6:30 PM; Individual 11 – found on top of leaf litter in open field 85 m south of field station at 7:35 PM; Individuals 12 – 16 – found on top of leaf litter in open field 85 m south of field station at 9:50 AM; Individuals 18–22 – found on top of leaf litter in open field 85 m south of field station at 2:50 PM

Identification. The only species of *Sphaerodactylus* on the northern part of mainland Puerto Rico are *S. g. guarionex* and *S. klauberi* (sensu Daza et al. 2019). *Sphaerodactylus g. guarionex* is distinguished from *S. klauberi* by its smaller size and lighter color (larger total length and snout-vent-length and dark, near-black color in *S. klauberi*); *S. g. guarionex* is distinguished by other subspecies of *S. grandisquamis* by its reduced number of dorsal body scales (~14 for *S. g. guarionex*, 17–23 in *S. g. grandisquamis*, *S. g. spanius*, *S. g. mimetes*, and *S. g. ateles*) and rounded snout scales (Daza et al. 2019). Molecular and morphological data from recent studies support the claim that *Sphaerodactylus* in the northern part of the mainland are *S. g. guarionex* or *S. klauberi* (Daza et al. 2019; Reynolds et al. 2021).

Family Typhlopidae

Anillotyphlops sp.

Materials examined. PUERTO RICO – **Arecibo** * Mata de Platano Field Station and Nature Reserve; 18.414, -66.729; 151 m above sea level; Justin Matthew Bernstein, Camilo Andres Calderon-Acevedo, Pedro Ivo Monico, Lazaro Willian Vinola-Lopez, J. Angel Soto-Centeno; Individual 1 – found in abandoned termite nest on side of trail ~ 2 m above the ground, ~125 m southwest of field station, at 11:00 PM. Individual quickly escaped and fell down an escarpment upon discovery.

Identification. Individual could not be identified to the species level, but is distinguished from all other snakes on the island by its smooth, shiny scales, extremely small size with cylindrical body (~15 cm total length), neck not visibly distinct from head, and the utilization of termite nest microhabitats.

Family Dipsadidae

Borikenophis portoricensis (Reinhardt & Lutken, 1862)

Figure 3F

Materials examined. PUERTO RICO – **Arecibo** * Mata de Platano Field Station and Nature Reserve; 18.414, -66.729; 151 m above sea level; Justin Matthew Bernstein, Camilo Andres Calderon-Acevedo, Pedro Ivo Monico, Lazaro Willian Vinola-Lopez, J. Angel Soto-Centeno; Individual 1 – found under tarp from an old harp net bat trap on side of trail, ~10 m from the entrance of Cueva de los Culebrones, at 12:52 PM.

Identification. Easily diagnosed from blind snakes (*Anillotyphlops*, *Typhlops*), by its significantly larger size total length and circumference, and enlarged eyes. As a racer, it is not similar in appearance to *Xenocrophis* or *Chilabothrus*. *Borikenophis portoricensis* is distinguished from *Magliophis* by its larger size (*Magliophis* ~ 0.5 m; *Borikenophis* from this study ~1–1.2 m total length). *Borikenophis portoricensis* can be distinguished from its congeners by distribution and morphology: *B. prymnus* is smaller and paler in color and is found in southern Puerto Rico and *B. variegatus* is endemic to Mona Island.

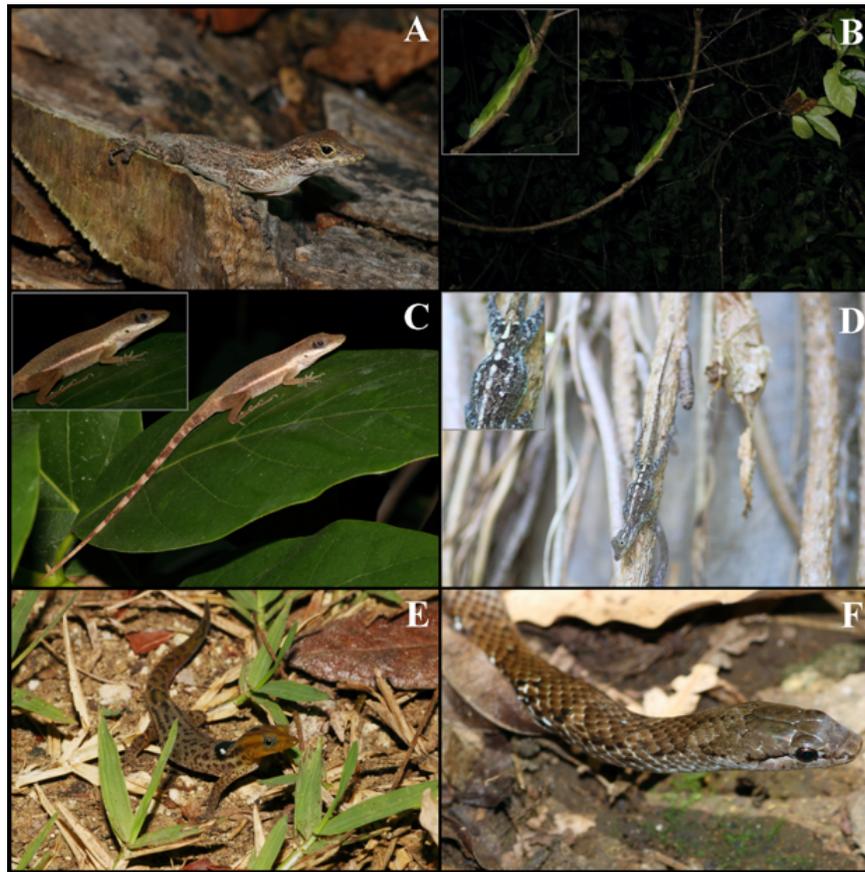


Figure 3. Lizards and snakes found at the Mata de Plátano Field Station and Nature Reserve. **A.** *Anolis cristatellus* .**B.** *Anolis cuvieri* , perched on a high branch; inset image zooms in on individual, showing the prominent crests and bright green color. **C.** *Anolis kugri* ; note the lateral lines and flecks of dark pigmentation on the flanks in the inset image.**D.** *Anolis stratulus* ; inset image better shows the saddle-shaped blotches on the dorsum. **E.** *Sphaerodactylus grandisquamis guarionex* . **F.** *Borikenophis portoricensis* . All photographs taken by Justin M. Bernstein.

Family Boidae

Chilabothrus inornatus (Reinhardt, 1843)

Figure 4A–H

Materials examined. PUERTO RICO – **Arecibo** * Mata de Platano Field Station and Nature Reserve; 18.414, -66.729; 151 m above sea level; Justin Matthew Bernstein, Camilo Andres Calderon-Acevedo, Pedro Ivo Monico, Lazaro Willian Vinola-Lopez, J. Angel Soto-Centeno; Individual 1–8 – adult individuals found hanging on branches or on rock ledges of entrance of Cueva de los Culebrones, either perched or dangling vertically. One individual observed eating *Mormoops blainvillei* . All individuals seen at once at 7:00 PM; Individuals 9–11 – juvenile individuals found hanging vertically from branches or rock ledges of entrance of Cueva de los Culebrones at 7:00 PM. All juveniles seen at the same time as Individuals 1–8; Individual 12 – found inside Cueva de los Culebrones ~17.6 m depth moving along the ground; Individuals 13–14 – adult skeletons, found at ~17.6 m depth in Cueva de los Culebrones; one skeleton ~30 m past cave entrance; second skeleton ~15 m before cave thermocline at ~20 m depth. Individuals 15–16 – live adults, found coiled on limestone wall ledges ~1 m above the ground at the point of the thermocline inside Cueva de los Culebrones, at ~20 m depth.

Identification. As the only boa on Puerto Rico, this snake is unequivocally identifiable as *E. inornatus* . Its large, stout body, grey/silver scales, and the lack of labial thermic receptors are key characters of this species. *Chilabothrus inornatus* is distinguished from *C. granti* by the latter only being found on satellite islands (Culebra, and islets to the east) and *C. monensis* only found on Mona Island. Bones found in Cueva de los Culebrones were identified by the enlarged, recurved teeth characteristic of boids; all other snakes on the island lack these and have much smaller teeth.

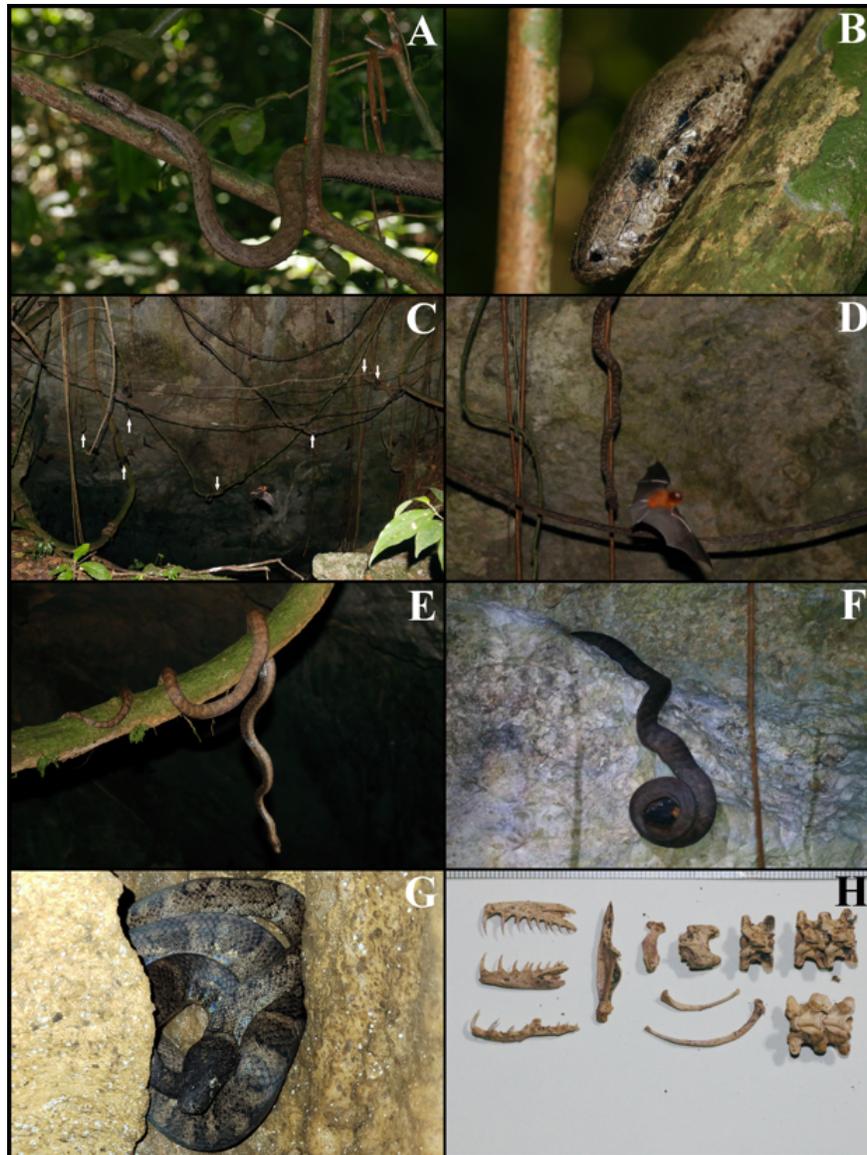


Figure 4. *Chilabothrus inornatus* from Cueva de los Culebrones. **A.** Lateral view of *C. inornatus* perches on a branch. **B.** Lateral shot of head, perched on a high branch. **C.** Entrance of Cueva de los Culebrones at night, as bats fly out of the cave and six individuals (white arrows) of *C. inornatus* wait to catch their prey. **D–E.** Two difference individuals of *C. inornatus* hanging vertically to catch bats flying out of the cave; Panel D shows an individual of *Mormoops blainvillei* flying in front of a Puerto Rican Boa. **F.** A Puerto Rican Boa constricting its prey, *M. blainvillei*. **G.** A dark pigmented individual of *C. inornatus* from the thermocline inside Cueva de los Culebrones. **H.** Bones of *C. inornatus* found inside Cueva de los Culebrones. Cranial elements, vertebrae, and ribs were found. All photographs taken by Justin M. Bernstein.

Chiroptera

Family Mormoopidae

Mormoops blainvillei Leach, 1821

Figure 5A

Materials Examined. PUERTO RICO – **Arecibo** * Mata de Plátano Field Station and Nature Reserve; 18.414, -66.729; 151 m above sea level; Justin Matthew Bernstein, Camilo Andrés Calderón-Acevedo, Pedro Ivo Mónico, Lázaro Willian Viñola-Lopez, J. Angel Soto-Centeno; captured in six-meter mist net in open field 75 m south of field station between 6:45 PM and 8:30 PM; 1 , ASC 1490; 1 , ASC 1485.

Identification. The Antillean ghost-faced bat (*M. blainvillei*) has a unique facial morphology that easily identifies it in the field. Nose-leaf absent, snout is short and adorned with skin folds, the skin flap in the lower lip is split in two, giving the appearance of paired leaflets. Fur bright orange/reddish, the ears are joined by a membrane across the head. The ears are broad and round, with the outer rims connecting to the lower lip which gives the eyes the appearance of being immersed in the ear, inside a funnel. Size small, total length = 78-87 mm (tail length =21 mm), forearm= 45–48 mm) (Gannon et al., 2005; Wilson, 2023a).

Pteronotus portoricensis Miller, 1902

Figure 5B

Materials Examined. PUERTO RICO – **Arecibo** * Mata de Platano Field Station and Nature Reserve; 18.414, -66.729; 151 m above sea level; Justin Matthew Bernstein, Camilo Andres Calderon-Acevedo, Pedro Ivo Monico, Lazaro Willian Vinola-Lopez, J. Angel Soto-Centeno; captured in six-meter mist net in open field 75 m south of field station between 6:45 PM and 8:30 PM; 1 , ASC 1492.

Identification. The Puerto Rican mustached bat (*P. portoricensis*) has dark grey to greyish-brown fur coloration, with ventral hairs being paler. Nose-leaf absent, the snout protrudes more than in *M. blainvillei*, with the skin flap in the lower lip continuous and not split. The ears are pointed and with straight edges, not joined in the middle, eye position normal. It can only be confused with *P. quadridens*, however its considerably larger with a total length of 78–83 mm, and a forearm over 44 mm. Additionally it possesses a fleshy knob above the snout, which is lacking in *P. quadridens* (Gannon et al., 2005; Pavan, 2023).

Pteronotus quadridens Gundlach, 1840

Figure 5C

Materials Examined. PUERTO RICO – **Arecibo** * Mata de Platano Field Station and Nature Reserve; 18.414, -66.729; 151 m above sea level; Justin Matthew Bernstein, Camilo Andres Calderon-Acevedo, Pedro Ivo Monico, Lazaro Willian Vinola-Lopez, J. Angel Soto-Centeno; captured in six-meter mist net in open field 75 m south of field station between 6:45 PM and 8:30 PM; 2 , ASC 1484, ASC 1486; 3 , ASC 1484, 1489, ASC 1491.

Identification. The sooty mustached bat (*P. quadridens*) has greyish-brown fur with tricolored individual hairs. Nose-leaf absent, as in *P. portoricensis*, the snout protrudes more than in *M. blainvillei*, with the skin flap in the lower lip continuous and not split. The ears are pointed and with straight edges, not joined in the middle, eye position normal. Considerably smaller than *P. portoricensis*, total length = 59–80 mm, forearm length = 36–39 millimeters. Can be discriminated from *P. portoricensis* by having a row of three to five small bulbs above each nostril, and the lack of a fleshy knob above the snout (Gannon et al., 2005; Wilson, 2023b).

Family Phyllostomidae

Artibeus jamaicensis Leach, 1821

Figure 5D

Materials Examined. PUERTO RICO – **Arecibo** * Mata de Platano Field Station and Nature Reserve; 18.414, -66.729; 151 m above sea level; Justin Matthew Bernstein, Camilo Andres Calderon-Acevedo, Pedro Ivo Monico, Lazaro Willian Vinola-Lopez, J. Angel Soto-Centeno; captured in six-meter mist net in open field 75 m south of field station between 6:45 PM and 8:30 PM; 1 , ASC 1487; 1 , ASC 1493.

Identification. Jamaican fruit-eating bats (*A. jamaicensis*) were identified by their ashy-gray coloration and faint but noticeable lighter color stripes on the rostrum. These bats have a broad nose leaf, a large central chin papillae surrounded by smaller ones, and a tail membrane that forms a V shape with no tail. Jamaican fruit bats are medium sized, one of the stockier bats on the island, have broad dark brown wings, and are commonly captured on understory mist nets. We identified a small colony of Jamaican fruit bats present in Cueva Larvas.

Brachyphylla cavernarum Gray, 1834

Figure 5E

Materials Examined. PUERTO RICO – **Arecibo** * Mata de Platano Field Station and Nature Reserve; 18.414, -66.729; 151 m above sea level; Justin Matthew Bernstein, Camilo Andres Calderon-Acevedo, Pedro Ivo Monico, Lazaro Willian Vinola-Lopez, J. Angel Soto-Centeno; captured in six-meter mist net in open field 75 m south of field station between 6:45 PM and 8:30 PM; 1 , ASC 1487; 1 , ASC 1493.

Identification. Antillean fruit-eating bats (*B. cavernarum*) are medium sized and identified by their light brown to grayish pelage that is lighter color at the base. These bats have a small and rudimentary nose-leaf that almost give it a pig-like appearance. Small papillae on the chin of Antillean fruit-eating bats form a distinctive V shape. The wings are broad and grayish in color. This species is a year-round resident of Cueva de los Culebrones.

Erophylla bombifrons Miller, 1899

Figure 5F

Materials Examined. PUERTO RICO – **Arecibo** * Mata de Platano Field Station and Nature Reserve; 18.414, -66.729; 151 m above sea level; Justin Matthew Bernstein, Camilo Andres Calderon-Acevedo, Pedro Ivo Monico, Lazaro Willian Vinola-Lopez, J. Angel Soto-Centeno; observed roosting and flying in first open room of Cueva de los Culebrones.

Identification. Brown flower bats (*E. bombifrons*) have light brown to yellowish colored fur that is very short. We identified roosting and flying brown flower bats at Cueva de los Culebrones by their characteristic hair color, which easily reflects light. In the hand, brown flower bats are small bats with a slightly elongated and semi-naked rostrum. Their nose leaf is small and pointy. They have a V shaped tail membrane and a tail shorter than the femur extends beyond the membrane. These bats are abundant at Cueva de los Culebrones and often are hunted by the Puerto Rican boa. Although no individuals were captured in mist nets, brown flower bats can be captured in understory mist nets set close to fruiting Panama berry trees (*Muntingia calabura*), piper plants (*Piper aduncum*), or turkey berry plants (*Solanum torvum*). This species is a year-round resident of Cueva de los Culebrones.

Monophyllus redmani Leach, 1821

Figure 5G

Materials Examined. PUERTO RICO – **Arecibo** * Mata de Platano Field Station and Nature Reserve; 18.414, -66.729; 151 m above sea level; Justin Matthew Bernstein, Camilo Andres Calderon-Acevedo, Pedro Ivo Monico, Lazaro Willian Vinola-Lopez, J. Angel Soto-Centeno; captured in six-meter mist net in open field 75 m south of field station between 6:45 PM and 8:30 PM; 1 , ASC 1488.

Identification. The Greater Antillean long-tongued bat (*M. redmani*) is easily identified by being the smallest leaf-nosed bat on the island. This primarily nectarivorous species has grayish brown pelage, sometimes with patches of white hairs present on the dorsal side. The ventral side is lighter grayish brown in color. This bat has an elongated rostrum culminating in a distinctive arrow shaped nose leaf. The tail membrane is V shaped and a short tail extends beyond the tip of the membrane. Greater Antillean long-tongued bats are captured in understory mist nets near fruiting Panama berry trees (*M. calabura*) and flowering endemic Maga trees (*Thespesia grandiflora*). This species is a year-round resident of Cueva de los Culebrones.

Stenoderma rufum Desmarest, 1820

Figure 5H

Materials Examined. PUERTO RICO – **Arecibo** * Mata de Platano Field Station and Nature Reserve; 18.414, -66.729; 151 m above sea level; Justin Matthew Bernstein, Camilo Andres Calderon-Acevedo, Pedro Ivo Monico, Lazaro Willian Vinola-Lopez, J. Angel Soto-Centeno; captured in six-meter mist net in open field 75 m south of field station between 6:45 PM and 8:30 PM; 1 , ASC 1494.

Identification. The red fig-eating bat (*S. rufum*) is the only other member of the subfamily Stenodermatinae inhabiting Puerto Rico. Nose leaf present and broad, as in *A. jamaicensis* , its fur is tan to dark chocolate-brown (its conspecifics inhabiting St. Croix and St. John having a reddish hue in their fur), the venter is lighter than the back, and it is the only bat in Puerto Rico with distinctive white epaulettes. Although it is similar to *A. jamaicensis* , it can be diagnosed by its smaller size, total length = 60–73 mm and forearm length = 46–52 mm. Additionally it lacks any facial stripes (Gannon et al., 2005; Genoways, 2023). The connectivity and abundance of its populations is affected by seasonal climatic disturbances like hurricanes (Calderon-Acevedo et al., 2021; Gannon & Willig, 1994).

Family Vespertilionidae

Eptesicus dutertreus Gervais, 1837

Figure 5A

Materials Examined. PUERTO RICO – **Arecibo** * Mata de Platano Field Station and Nature Reserve; 18.414, -66.729; 151 m above sea level; Justin Matthew Bernstein, Camilo Andres Calderon-Acevedo, Pedro Ivo Monico, Lazaro Willian Vinola-Lopez, J. Angel Soto-Centeno; captured in six-meter mist net in open field 75 m south of field station between 6:45 PM and 8:30 PM; 1 , ASC 1483.

Identification. The identity of Greater Antillean serotine bats (*E. dutertreus*) was confirmed by their characteristically dark chocolate brown fur, and fully naked nearly black round ears, wing, and tail membranes. Both the tail and wing membranes look oily. The rostrum of Greater Antillean serotines is naked and wide, giving it an appearance of being inflated, a trait not found in other bats in Puerto Rico. These bats are fast fliers that forage above the canopy of trees. Our capture of Greater Antillean serotine bats in a forest corridor using understory mist nets is attributed to the presence of Cueva Larvas that serves as a roost nearby.

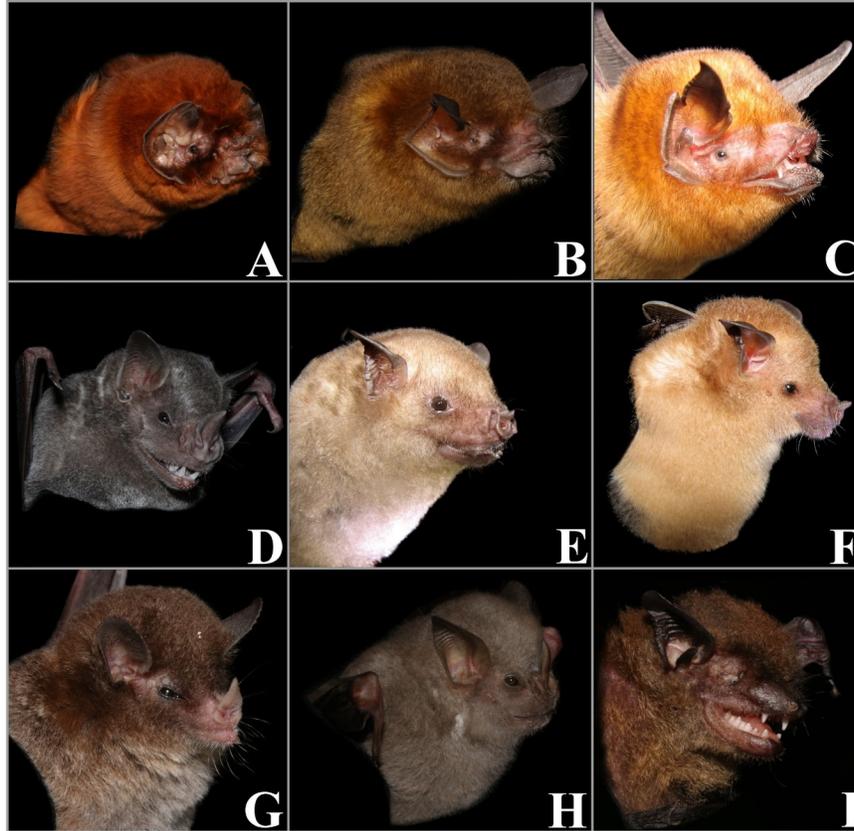


Figure 5. Bats caught in the mist nets at Mata de Plátano. Photos and parts of the body have been cropped out for easier viewing of headshots. **A.** *Mormoops blainvillei* . **B.** *Pteronotus portoricensis* . **C.** *Pteronotus quadridens* . **D.** *Artibeus jamaicensis* . **E.** *Brachyphylla cavernarum* . **F.** *Erophylla bombifrons* . **G.** *Monophyllus redmani* . **H.** *Stenoderma rufum* . **I.** *Eptesicus dutertrei* . Photo credits: A,B,D,G,H,I: Justin M. Bernstein; C,E,F: Angel Soto-Centeno.

Discussion

Mata de Plátano Field Station and Nature Reserve (MPFS) is best known for its bat-snake interactions, yet no faunal surveys for either of these groups have been published. Our study shows that while small ($\sim 5100 \text{ m}^2$), this reserve has a rich herpetofauna and bat fauna representative of the overall diversity of the island. This rapid inventory provides the first local, taxonomic-focused checklist for these species in north-central Puerto Rico.

In our 10-day rapid inventory, we found a total of 14 species of reptiles and amphibians. We documented four amphibians, seven lizards, and three snakes, totaling up to $\sim 22\%$ (4 out of 18) and $\sim 14\%$ (10 out of 72) of the amphibians and squamate diversity on Puerto Rico. Our observations in during field work also provide important natural history information. We documented *A. cristatellus* copulating on the field station walls, which is not surprising as this species is often found in man-made structures throughout the island and is abundant in urban areas. Additionally, we documented two morphs of *A. cristatellus* : 1) light grey/tan (with or without darker mottling), and 2) a morph that is dark or light brown with a light yellow or cream colored mid-dorsal stripe and light-colored dorsal and lateral flecks. The dorsum of the first morph sometimes has dark gray or black spots running down the spine but are not nearly as distinct or as large as the saddle-shaped blotched of *A. stratulus*(Fig. 6). The dorsal crest and tail fin in both morphs is sometimes prominent, while other observations the cutest was hardly distinct from the rest of the body. We also report

notes on the endemic *Chilabothrus inornatus*. This species is known for consumption of bats on the island, and many individuals aggregate at the entrance and inside caves to opportunistically catch them. We saw one adult individual attack and devour a ghost faced bat (*Mormoops blainvillei*). In our night surveys, we observed juvenile *C. inornatus* snakes ($N = 3$) at the entrance of Cueva de los Culebrones, which suggests an actively breeding population of this endemic snake. We also found three live (and an additional two separate skeletons) *C. inornatus* inside the cave, at 17.6 m and ~ 20 m depth. The latter of these two depths is the thermocline of the cave ($\sim 35^\circ\text{C}$), where we found two live *C. inornatus*. Individuals found deeper in the cave range from light grey to dark, charcoal grey (Fig. 5G). Compared to the ambient temperature (average: $24.4\text{--}31.1^\circ\text{F}$), the endemic Puerto Rican Boas tolerate a wide range of temperatures.

During this rapid inventory we observed nine species of bat, all of which were documented in a single 1.75-hour period of mist netting. This bat diversity represents 70% (i.e. 9 of 13) of the living alpha diversity present on the island of Puerto Rico. Most of the bats we observed are residents of MPFS. While our sampling efforts do not permit a more thorough examination of species abundance or comparisons with other reserves in the island, these data highlight the importance of MPFS as a local center of bat diversity. The moist forest area where MPFS is located is adjacent to pastures, unprotected rustic forest areas, and the urbanized center of the municipality of Arecibo to the north. However, more importantly, the station connects with the larger Río Abajo State Forest to the south. Together these two protected areas form a hub in the northcentral part of Puerto Rico extending from coastal to mountainous areas and linking multiple forested corridors that connect with reserves along the Karst Conservation Zone (Calderón-Acevedo et al., 2001).

Two endemic bat species documented in this rapid survey are of particular importance. The endemic Puerto Rican moustached bat (*Pteronotus portoricensis*) specifically roosts in hot cave chambers where temperatures often exceed 35°C , such as those present in Cueva de los Culebrones (Rodríguez-Durán and Soto-Centeno, 2003). Previous studies show that the population this species at Cueva de los Culebrones was not affected by hurricanes (Jones et al., 2001). Nonetheless, *P. portoricensis* seems to be a new resident to the cave, and thus effects of natural phenomena on this species at this locality are not well known. A single individual of another endemic, the red fig-eating bat (*Stenoderma rufum*), was captured during our survey. This endemic frugivorous bat is known to roost in the thick foliage of trees and occurs in low abundance throughout the island (Genoways 2023; Calderón-Acevedo et al., 2021). Given these characteristics, *S. rufum* is a species particularly affected by strong hurricanes (Gannon and Willig 1994), which can decrease the structural habitat connectivity through the island. The protection of MPFS in the wider northcentral habitat connectivity hub of Puerto Rico (Calderón-Acevedo et al., 2021), may be key for the recovery and population connectivity of this rare bat.

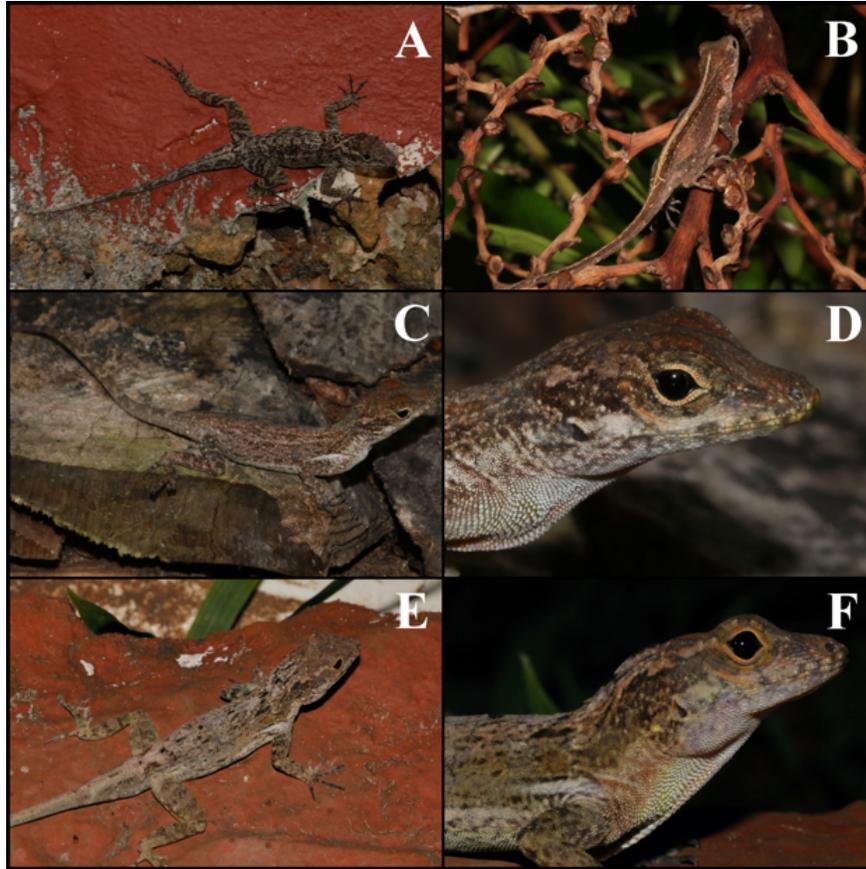


Figure 6. Variation seen in *Anolis cristatellus* from the Mata de Plátano Field Station. **A.** Grey/tan patterning with heavily mottling. **B.** Brown morph with mid-dorsal yellow stripe and light dorsal and lateral flecks. **C.** Brown morph with no mottling or mid-dorsal spots, light flecks present. **D.** Lateral shot of the head of the individual from Panel C. **E.** Brown morph with light mottling and striping, and dark spots running down the spine. Note the slightly raised dorsal crest (more prominent at the tail). **F.** Lateral shot of the head of the individual from Panel F. All photographs taken by Justin M. Bernstein.

To our knowledge, this is the first faunal checklist on the bat and herpetofauna of Puerto Rico. Our findings expand the current knowledge of biodiversity and species richness in this protected region. Although more standardized methods over greater periods of time will provide more insight on species abundances, our results show that *A. cristatellus* and *S. grandisquamis guarionex* likely contribute large portions to the vertebrate biomass here, as has been found in other studies (Rodda et al. 2001). There are likely more species in Mata de Plátano. For example, there have been several accounts of *A. occultus* from the field station (pers. comm. Abel Vale, 2022). Although we did not see these species during our time at the reserve, future surveys will be needed to better understand the density of *A. occultus* and *N. leporinus* in this area. The Puerto Rican fauna has been studied well, yet new species have recently described (e.g., Díaz-Lameiro et al. 2022), thus it is critical to perform local, intensive surveys and document faunal inventories. These local intensive surveys and faunal checklists can provide a steady supply of data to understand the current status of Caribbean species. The main threats to Caribbean bats and herpetofauna stem from habitat loss and fragmentation related to human development, and climatic events that can drastically re-shape the local population connectivity of bats species (Calderón-Acevedo et al., 2021; Soto-Centeno & Calderón-Acevedo, 2023). Therefore, having updated local lists can provide a year-to-year comparison of local faunal abundance that can inform conservation strategies, and eventually strengthen the predictive power when modelling the

effect climate change of species richness and abundance. We encourage more researchers to publish faunal and floral lists, even for common taxa, to better understand species diversity, abundance, and interactions for downstream research and conservation.

Data Availability Statement

All research here was observational and no data beyond what is presented in this manuscript is available.

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References

- Arendt W.J., J. Faaborg, M. Canals, and J. Bauer. 2015. Bird checklist, Guánica Biosphere Reserve, Puerto Rico. Research Note SRS-23. US Forest Service, Southern Research Station, Ashville, NC, USA. 23 pp.
- Ballantine D.L. and N.E. Aponte. 1997. A revised checklist of the benthic marine algae known to Puerto Rico. *Caribbean Journal of Science* 33:150–179.
- Calderón-Acevedo C.A., A. Rodríguez-Durán, and J.A. Soto-Centeno. 2021. Effect of land use, habitat suitability, and hurricanes on the population connectivity of an endemic insular bat. *Scientific Reports* 11:9115.
- Daza J.D., B.J. Pinto, R. Thomas, A. Herrera-Martinez, D.P. Scantlebury D, L.F.P. García, R.P. Balaraman, G. Perry, and T. Gamble. 2019. The sprightly little sphaerodactyl: Systematics and biogeography of the Puerto Rican dwarf geckos *Sphaerodactylus* (Gekkota, Sphaerodactylidae). *Zootaxa* 4712:151–201.
- Díaz-Lameiro A.M., C.I. Villamil, T. Gamble, B.J. Pinto, A. Herrera-Martínez, R. Thomas, J.M. Bernstein, J.E. Titus-McQuillan, S.V. Nielsen, E. Agosto-Torres, A.R. Puente-Rolón, F.J. Bird-Picó, T.K. Oleksyk, J.C. Martínez-Cruzado, and J.D. Daza. 2022. A new species of *Sphaerodactylus* (Gekkota: Sphaerodactylidae) from the Northwest Limestone Region of Puerto Rico. *Ichthyology & Herpetology* 110(3):449–465.
- Ewel J.J. and J.L. Whitmore. 1973. The Ecological Life Zones of Puerto Rico and the U.S. Virgin Islands. USDA Forest Service, Institute of Tropical Forestry, Research Paper ITF-018.
- Gannon, M.R., A. Kurta, A. Rodríguez-Durán, and M.R. Willig. 2005. *Bats of Puerto Rico: an island focus and a Caribbean perspective*. 224 pp. Texas Tech University Press, Lubbock.
- Gannon, M.R., and M.R. Willig. 1994. The effects of Hurricane Hugo on bats of the Luquillo Experimental Forest of Puerto Rico. *Biotropica* 26(3): 320–331.
- Genoways, H.H. 2023. *Stenoderma rufum*. In: A. Kurta and A. Rodríguez-Durán (Eds.), *Bats of the West Indies: A Natural History and Field Guide*, pp. 297–301. Cornell University Press, Ithaca.
- Ingram T., S.T. Giery, J.B. Losos. 2022. Hierarchical partitioning of multiple niche dimensions among ecomorphs, species and sexes in Puerto Rican anoles. *Journal of Zoology* 318(2): 127–134.
- Jones, K.E., K.E. Barlow, N. Vaughan, A. Rodríguez-Durán, and M.R. Gannon. 2001. Short-term impacts of extreme environmental disturbance on the bats of Puerto Rico. *Animal Conservation* 4:59–66.
- Joglar, R., L.A.O. Álvarez, T.M. Aide, D. Barber, P.A. Burrowes, M.A. García, A. León-Cardona, A.V. Longo, N. Pérez-Buitrago, A. Puente, N. Ríos-López, and P.J. Tolson. 2011. Conserving the Puerto Rican herpetofauna. In: Hailey, A., B.S. Wilson, and J.A. Horrocks (Eds.), *Conservation of Caribbean Island Herpetofaunas*, pp 339–358, Volume 2. Regional Accounts of the West Indies. Brill, Leiden, The Netherlands.

- Lugo A.E., L.M. Castro, V. Abel, T. del M. López, E.H. Prieto, and A.G. Martinó, A.R. Puente Rolón, A.G. Tossas, D.D. McFarlane, T. Miller, A. Rodríguez, J. Lundberg, J. Thomlinson, J. Colón, J.H. Schellekens, O. Ramos, and E. Helmer. 2001. Puerto Rican Karst - A Vital Resource. U.S. Department of Agriculture Forest Service General Technical Report WO-65, 2001.
- Monroe W.H. 1976. The karst landforms of Puerto Rico. U.S. Geological Survey Professional Paper.
- Ospina-Sánchez C., F. Soto-Adames, and G. González. 2020. Checklist and distribution of Collembola from Greater Puerto Rico. *Biodiversity Data Journal* 8:1–33
- Pavan, A.C. 2023. *Pteronotus portoricensis*. In: A. Kurta and A. Rodriguez-Duran (Eds.), *Bats of the West Indies, A Natural History and Field Guide*, pp. 160–163. Cornell University Press, Ithaca.
- Pérez-Reyes O., T.A. Crowl, P.J. Hernández-García, R. Ledesma-Fusté, F.A. Villar-Fornes, and A.P. Covich. 2013. Freshwater decapods of Puerto Rico: a checklist and reports of new localities. *Zootaxa* 3717(3): 329–344.
- Pinto B.J., S.E. Keating, S.V. Nielsen, D.P. Scantlebury, J.D. Daza, and T. Gamble. 2022. Chromosome-level genome assembly reveals dynamic sex chromosomes in neotropical leaf-litter geckos (Sphaerodactylidae: *Sphaerodactylus*). *Journal of Heredity* 113:272–287.
- Pinto B.J., J. Titus-McQuillan, J.D. Daza, and T. Gamble. 2019. Persistence of a geographically-stable hybrid zone in Puerto Rican dwarf geckos. *Journal of Heredity* 110:523–534.
- Puente-Rolón, A.R. 1999. Foraging behavior, home range, movements, activity patterns and habitat characterization of the Puerto Rican boa (*Epicrates inornatus*) at Mata de Platano Reserve in Arecibo, Puerto Rico. Doctoral dissertation, University of Puerto Rico, Mayaguez (Puerto Rico).
- Ramírez A., N. Maldonado-Benítez, A. Mariani-Ríos, and J. Figueroa-Santiago. 2020. Dragonflies and damselflies (Odonata) from Puerto Rico: a checklist with notes on distribution and habitat. *PeerJ* 8:e9711.
- Reynolds R.G., A.H. Miller, A. Ríos-Franceschi, C.A. Huffine, J. Fredette, N.F. Angeli, S.I. Vega-Castillo, L.J. Revell, and A.R. Puente-Rolón. 2021. Molecular phylogeny of Puerto Rico Bank dwarf geckos (Squamata: Sphaerodactylidae: *Sphaerodactylus*). *bioRxiv*, <https://doi.org/10.1101/2021.03.23.436310>.
- Rivero J.A. 1998. Los Anfibios y Reptiles de Puerto Rico - The Amphibians and Reptiles of Puerto Rico. University of Puerto Rico Press, San Juan.
- Rodda G.H., G. Perry, R.J. Rondeau, and J. Lazell. 2001. The densest terrestrial vertebrate. *Journal of Tropical Ecology* 17:331–338.
- Rodríguez-Durán, A. and J.A. Soto-Centeno. 2003. Temperature selection by tropical bats roosting in caves. *Journal of Thermal Biology* 28:465–468.
- Soto-Centeno, J.A., and C.A. Calderón-Acevedo. 2023. Global Change and the Conservation of Caribbean Bat Communities. In A. Kurta & A. Rodríguez-Durán (eds.), *Bats of the West Indies, A Natural History and Field Guide* (pp. 72–86). Cornell University Press, Ithaca.
- Uetz, P., P. Freed, R. Aguilar, F. Reyes, J. Kudera, and J. Hošek (eds.). 2023. The Reptile Database, <http://www.reptile-database.org>, accessed 1 March 2023.
- Vélez Jr. Jr. M.J. 1967. Checklist of the terrestrial and freshwater Decapoda of Puerto Rico. *Caribbean Journal of Science* 7:41–44.
- Wilson, A.K. 2023a. *Mormoops blainvillei*. In: A. Kurta and A. Rodriguez-Duran (Eds.), *Bats of the West Indies, A Natural History and Field Guide*, pp. 139–143. Cornell University Press, Ithaca.
- Wilson, A.K. (2023b). *Pteronotus quadridens*. In: A. Kurta and A. Rodriguez-Duran (eds.), *Bats of the West Indies, A Natural History and Field Guide* (pp. 167–171). Cornell University Press, Ithaca.

Wogan G.O.U., M.L. Yuan, D.L. Mahler, and I.J Wang. 2020. Genome-wide epigenetic isolation by environment in a widespread *Anolis* lizard. *Molecular Ecology* 29:40–55.

Author contribution

The authors of this manuscript provided the following contributions to this work: Justin M. Bernstein: Conceptualization (Lead), Data curation (Equal), Formal analysis (Equal), Investigation (Equal), Methodology (Equal), Resources (Supporting), Visualization (Lead), Writing – original draft (Lead), Writing – review & editing (Equal). Camilo Andres Calderon-Acevedo: Investigation (Equal), Methodology (Equal), Writing – review & editing (Equal). Pedro Ivo Monico: Investigation (Equal), Methodology (Equal), Writing – review & editing (Supporting). Lazaro Willian Vinola-Lopez: Investigation (Equal), Methodology (Equal), Writing – review & editing (Supporting). J. Angel Soto-Centeno: Data curation (Equal), Funding acquisition (Lead), Investigation (Equal), Methodology (Equal), Resources (Lead), Supervision (Equal), Visualization (Supporting), Writing – original draft (Supporting), Writing – review & editing (Equal).