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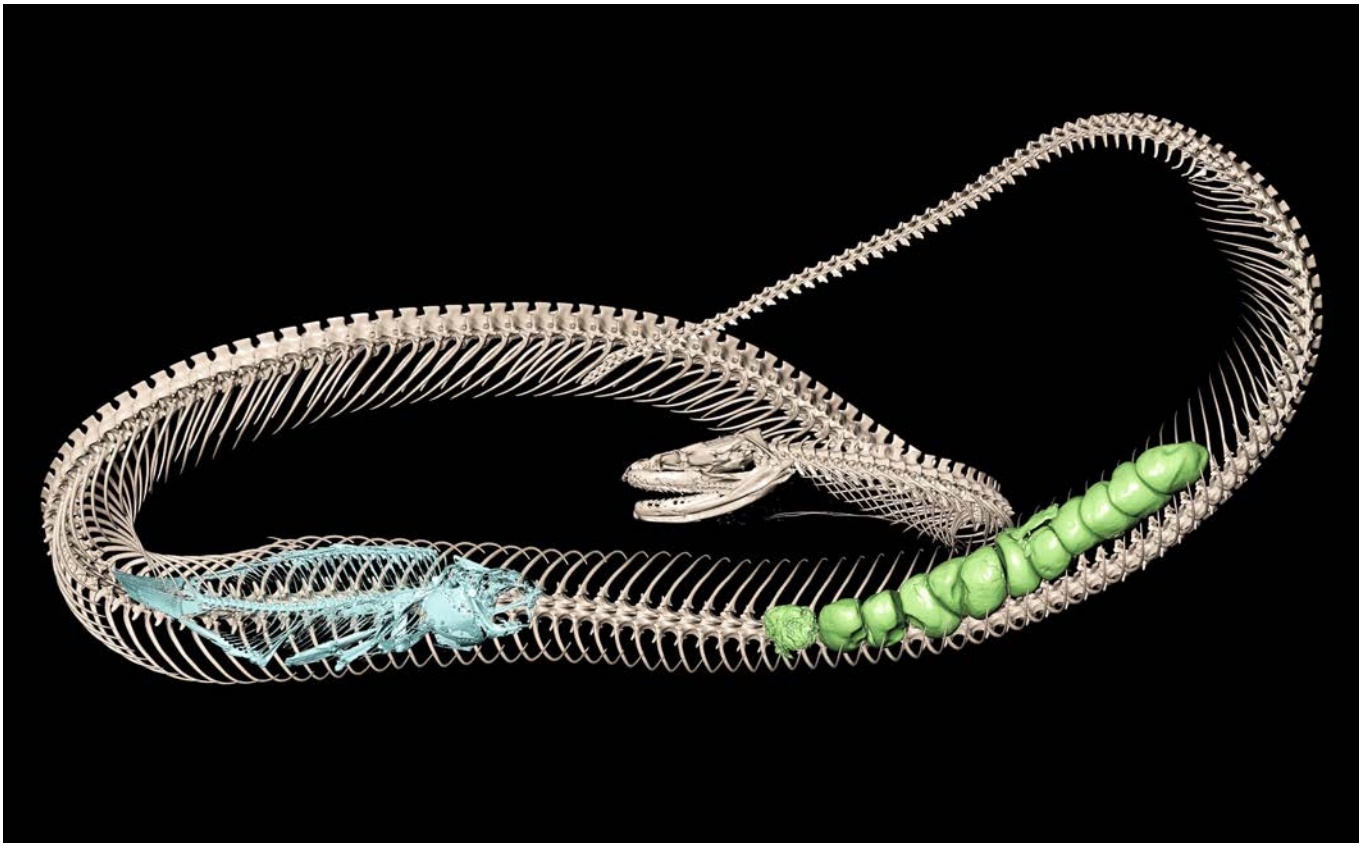

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Cover: Micro-computed tomogram of a preserved pregnant blackbelly snake, *Hydraethiops melanogaster*, from northwestern Gabon reveals its cichlid fish prey and a dozen eggs. Scan by Cédric d'Udekem d'Acoz.

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Bulletin of the Chicago Herpetological Society 58(9):141-149, 2023

Miscellanea Herpetologica Gabonica XVIII

Olivier S. G. Pauwels [1], Erwan Théleste [2], Piero Carlino [3], Laurent Chirio [4], Godefroy De Bruyne [5], Cédric d'Udekem d'Acoz [6], Lynn Gindorff [7], Maarten Van Steenberge [8,9,10], David Zipper [11] and Lee J. T. White [12]

Abstract

We present new Gabonese locality records, ecological and morphological data or unpublished material for *Chamaeleo dilepis* (Chamaeleonidae), *Hemidactylus mabouia* (Gekkonidae), *Feylinia boulengeri*, *Panaspis breviceps* (Scincidae), *Monopeltis* sp. (Amphisbaenidae), *Polemon collaris* (Atractaspididae), *Dasypeltis congolensis*, *Dipsadoboa duchesnii*, *Grayia ornata*, *Hapsidophrys smaragdinus*, *Philothamnus heterodermus*, *Thelotornis kirtlandii* (Colubridae), *Naja annulata* (Elapidae), *Mehelya poensis* (Lamprophiidae), *Hydraethiops melanogaster* (Natricidae), *Psammophis mossambicus* (Psammophiidae), *Atheris squamigera* and *Bitis arietans* (Viperidae). We report a clutch size of 12 eggs for *Hydraethiops melanogaster*, and a predation case by *Philothamnus heterodermus* on the Long-fingered Squeaker *Arthroleptis macrodactylus* (Anura: Arthroleptidae), by *Thelotornis kirtlandii* on *Hapsidophrys smaragdinus*, and by *Hydraethiops melanogaster* on the weakly electric fish *Paramormyrops batesii* (Osteoglossiformes: Mormyridae), on the African red-finned barb *Enteromius camptacanthus* (Cypriniformes: Cyprinidae), and on the Nile tilapia *Oreochromis niloticus* (Cichliformes: Cichlidae). We report a fatal envenomation case by *Naja annulata* in Nyanga Province. We refer all Gabonese records of *Dasypeltis confusa* to *D. congolensis*. We add two snake species to the herpetofauna of the Arboretum Raponda Walker, one snake to the Crystal Mounts National Park and Loango National Park each, one amphisbaenian and two snakes to the Plateaux Batéké National Park, and one snake to Haut-Ogooué Province.

Keywords

Biodiversity, herpetofauna, Squamata, snake bite, envenomation, protected areas, Gabon, Equatorial Africa.

Introduction

We pursue our contributions to the knowledge of the geographic distribution and natural history of the reptiles of Gabon in this 18th installment of the series Miscellanea Herpetologica Gabonica (see the previous installment by Pauwels, Zwerts et al., 2021). With the exception of the records made by PC and LC, all new field data presented here were gathered during non-herpetologically focused activities. Several observations made by ET in the course of primatological studies in the Haut-Ogooué Province allow adding several squamate taxa to the list of the herpetofauna of the Plateaux Batéké National Park and of the province. Several new predation records are based on the examination of stomach contents of museum-preserved specimens.

Material and Methods

New photographic and voucher material was identified using the keys and morphological information provided by Brygoo and Roux-Estève (1983); Branch et al. (2003); Pauwels and Vande weghe (2008); Pauwels, Albert et al. (2010); and Trape, Crochet et al. (2019). We have used Micro-Computed Tomography (μ-CT) at the microCT facilities of the RBINS = Royal Belgian Institute of Natural Sciences, using an EasyTom 150 (rX Solutions, Chavanod, France) with an aluminum filter at 9.9 w, 110 kv, 90 μA, 5.5 frames/s, 1440 projections per rotation

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and 16.74 isotropic voxel size. Segmentation of the scans was done using Dragonfly software, version 4.5.0.711 for Windows (Object Research Systems [ORS] Inc, Montreal, Canada, 2020). Visualization of the resulting meshes was done using GOM Inspect 2018 (Carl Zeiss GOM Metrology GmbH, Braunschweig, Germany).

Abbreviations: Morphology: A = anal plate; AT = anterior temporals; D = divided; DSR = number of dorsal scale rows; DTR = dorsal tubercle row(s); IL = (number of) infralabials (for snakes, followed in brackets by the number of IL in contact with the first pair of sublinguals); K = keeled; Lor = number of loreal scales; MSR = dorsal scale rows around midbody; PoO = number of postoculars; PreO = number of preoculars; PV = number of preventrals; S = single; SC = (number of) subcaudals; SL = (number of) supralabials (for snakes, followed in brackets by the number of SL in contact with the orbit); SubO = number of suboculars; SVL = snout–vent length; TaL = tail length; TL = total length; U = unkeeled; VEN = (number of) ventral scales. Institutions: MSNS = Museo di Storia naturale del Salento, Calimera, Italy; RBINS = Royal Belgian Institute of Natural Sciences, Brussels, Belgium. Varia: asl = above sea level; Dept = Department; NP = National Park; Prov. = Province.

Results

Chamaeleonidae
Chamaeleo dilepis Leach, 1819
On 1 February 2016 ET photographed an adult female individual (Figure 1) while it was crossing the Ozouga camp (2°07'04.8"S, 9°28'55.3"E) of the Loango Chimpanzee Project, about 6 km SE of Tassi, in Loango NP, Etimboue Dept, Ogooué-Maritime Prov. In total, ET made five observations of the same species—possibly of the same individual—at the very same location between 2015 and 2019. This new locality lies about 30 km NW of the locality published by Pauwels, Branch et al. (2004) in Ndougou Dept in the southern part of the park. Within Gabon, the distribution of the flap-necked chameleon is still poorly documented.

Gekkonidae
Hemidactylus mabouia (Moreau de Jonnès, 1818)
On 13 July 2013 LC encountered an adult male (RBINS 19193) in Bilolo (Ndoubi; 2°04'45.9"S, 11°35'47.5"E), Boumi-Louetsi Dept, Ngounié Prov. It showed a SVL of 62 mm, a TaL of 63 mm (last 31 mm regenerated), 13 DTR, widened SC, 33 preanofemoral pores in a near-continuous series (interrupted on the left side by a single poreless scale). New Dept record (see closest records by Pauwels, Kamdem Toham et al., 2002a; Dewynter et al., 2018). Being highly anthropophilic, *Hemidactylus mabouia* is by far the most commonly observed among Gabonese geckos. It is so common that it is, comparatively, not often vouchered, and, although presumably ubiquitous in human settlements, there are still many cities and villages from where it has not yet been documented.

Scincidae
Feylinia boulengeri Chabanaud, 1917
Described in 1917 from Ngomo (ca. 0°49'51.0"S, 9°59'04.3"E), Ogooué et Lacs Dept, in Moyen-Ogooué Prov., Boulenger's limbless skink has been also found in the late 1940s along the Mbilagone River (0°01'00.0"N, 9°48'00.0"E) in Komo-Océan Dept, Estuaire Prov. (Brygoo and Roux-Estève, 1983). Its small size, dull dark color and fossorial habits contribute to make this endemic Gabonese skink one of the most poorly known reptiles in western Central Africa, hitherto recorded only from those two localities. We report here a male individual (RBINS 22331; Figure 2) found by LC at the "Campement chez Beti" (0°02'19.7"S, 9°20'28.2"E; 2 m asl) near Pointe Nyonié, Komo-Océan Dept, Estuaire Prov. It shows a SVL of 74.5 mm, a TaL > 8.1 mm (autotomized when caught), a midbody diameter of 3.7 mm; a partly everted right hemipenis; a single supranasal; 4/4 SL; 2/2 IL; a large interparietal bordered posteriorly by two elongate parietals; a large mental and a single postmental. There are 20 scale rows at one head-length behind the head and 20 MSR (Brygoo and Roux-Estève [1983] counted 18 MSR in the two other known specimens). There are 122 scales between the postmental and the cloacal scales; i.e., exactly the number observed by Brygoo and Roux-Estève in the two other known specimens. In preservative fluid, its uniform brown and beige reticulate pattern is lighter on the belly than on the dorsum. Its eye appears as a whitish spot through the preocular and the ocular. The ocular is in contact with the 2nd SL. This new locality extends the known distribution of this species by about 50 km westwards. This very rarely encountered legless skink has never been specifically searched for since its description. Dedi-

Figure 1. Live adult female *Chamaeleo dilepis* in Loango National Park, Ogooué-Maritime Prov., western Gabon. Photograph by E. Theleste.

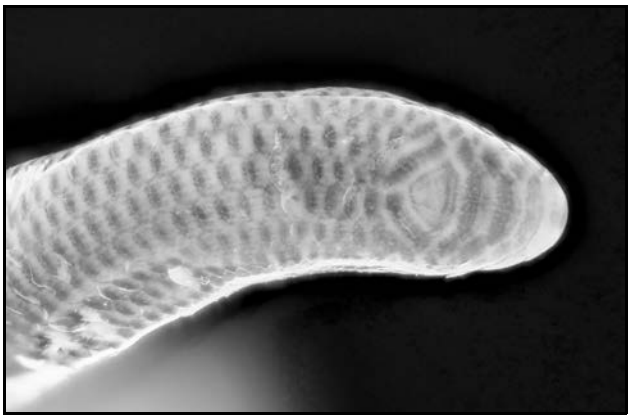

Figure 2. Dorsal view of the head of a preserved male *Feylinia boulengeri* from near Pointe Nyonié, Estuaire Prov., northwestern Gabon. Note the single supranasal, typical of this species. Photograph by J. Venderickx.

Figure 3. Right profile of the fore-body of a freshly dead *Monopeltis* sp. in Plateaux Batéké National Park, Haut-Ogooué Prov., southeastern Gabon. Photograph by E. Theleste.

cated field studies would possibly show that it is actually locally common in the lowland coastal forests of Gabon.

Panaspis breviceps (Peters, 1873)
The adult short-headed skink RBINS 19199 was caught by LC in 2011 in the Haute-vallée du Komo (0°22'13.8" N, 10°34'46.6"E), Komo Dept, Estuaire Prov. It has a SVL of 63 mm; a TaL of 89 mm (tail complete), 34 MSR, smooth; supranasals present. The same year and in the same Dept, LC caught a subadult individual in Tsibilé (0°22'19.3"N, 10°31'54.9"E). It shows a SVL of 44 mm; a TaL of 76 mm (tail complete), 36 MSR, smooth; supranasals present. New locality records (other records from Estuaire Prov. were presented by Pauwels, Kamdem Toham et al., 2002b). In a phylogenetic study on the species, Lokasola et al. (2021) used an individual from "Sassamongo, Ogooué-Ivindo, 0°50'N 13°28'E." This locality lies in Zadie Dept, from where this skink had not yet been reported (for records in Ogooué-Ivindo Prov., see Knoepffler, 1974; Pauwels and Vande weghe, 2008; and Carlino and Pauwels, 2015).

Amphisbaenidae
Monopeltis sp.
An adult individual was found by ET on 9 May 2023 on a forest trail (2°06'52.9"S, 14°04'08.4"E) near the camp of the Gorilla Protection Project in Mpassa Dept, Plateaux Batéké NP, Haut-Ogooué Prov. It was just after a heavy rain, the area had been flooded, and the amphisbaenian was freshly drowned. ET did not collect it but took several photographs (Figure 3). Its total length was about 30 cm. It shows elongate, parallel pectoral shields, and ca. 238 body annuli from the first one following the pectoral plates to the pore-bearing annulus, the latter excluded in the count (ventrally bifurcate annuli counted as single). There are additionally 8 lateral anterior annuli bordering the pectoral plates, i.e., a total number of body annuli of ca. 246. It has ca. 25 caudal annuli. Its head is covered by a large, single azygous shield with no traces of dividing lines. Only two species of *Monopeltis* are currently recorded from Gabon: *M. galeata* (Hallowell, 1852) and *M. schoutedeni* de Witte, 1933, the latter having been recently added by Pauwels, Albert et al. (2010). The former is known by a handful of specimens found in the coastal region (Branch et al., 2003), and the only Gabonese record of the latter was made 10 km NE of Léconi, in Plateaux Dept, Haut-Ogooué Prov. (Pauwels, Albert et al., 2010). The high numbers of body and caudal annuli and the pectoral shield pattern preclude an identification as *Monopeltis galeata*. The

Figure 4. Live adult *Dasypeltis congolensis* in Lopé National Park, Ogooué-Ivindo Prov., central Gabon. Photograph by G. De Bruyne.

number of body annuli is far below the variation known for *Monopeltis schoutedeni* (dos Santos, 2013). Morphologically, it seems more closely related to *Monopeltis guentheri* Boulenger, 1885, a Congolese species not recorded from Gabon. Given that the photographs of the specimen do not show several important diagnostic characters and in the absence of a preserved voucher specimen, we will refrain from attempting a specific identification. In any case, the genus *Monopeltis* is here recorded for the first time from Plateaux Batéké NP and from Mpassa Dept.

Atractaspididae
Polemon collaris (Peters, 1881)
The adult male MSNS Rept 295 was found dead during the period November 2016 – March 2017 on the road to Ipassa Research Station (at ca. 0°31'15.2"N, 12°47'58.3"E), Ivindo NP, Ivindo Dept, Ogooué-Ivindo Prov. Its head and flanks were damaged by ants. The frontal is distinctly longer (4.3 mm) than wide (2.7 mm). No SL is in contact with the parietals. The temporal formula is 1+1 on both sides. It shows two pairs of sublinguals. Other morphological characters are presented in Table 1. The dorsal black color reaches the lateral angles of the ventrals (the white color of the venter does not reach the first dorsal row). Only a handful of specimens of this taxon are known from Gabon, and the morphological variation of the Gabonese population is not well documented. The morphology of this specimen agrees with that of two other specimens collected in Ipassa (Carlino and Pauwels, 2015).

Colubridae
Dasypeltis congolensis Trape, Mediannikov, Chirio & Chirio, 2021
An adult individual was photographed (Figure 4) on 13 April 2021 by GDB in a savanna with shrubs (0°06'47.25"S, 11°36'09.67"E) at the entrance of the CEDAMM (Complexe Educatif Dr Alphonse Mackanga Missandzou) in Lopé NP, Lopé Dept, Ogooué-Ivindo Prov. First documented record for the Dept and for the NP. Following the revision by Trape, Mediannikov et al. (2021) we refer all Gabonese records of *Dasypeltis confusa* Trape & Mané, 2006 (Pauwels and Vande weghe, 2008, and references therein; Pauwels and Sallé, 2009; Pauwels, 2016, 2017; Pauwels, Gillet et al., 2018; Pauwels, Morelle et al., 2019) to *D. congolensis*. The undocumented record of *Dasypeltis scabra* (Linnaeus, 1758) by Blanc and

Figure 5. Live *Dipsadoboa duchesnii* hatchling, born from an egg laid by a female found in Crystal Mounts NP, Estuaire Prov., northwestern Gabon. Photograph by L. Chirio.

Frétey (2000) from a savanna (0°06'43"S, 11°36'05"E) at a very close spot in the NP, interpreted as *D. confusa* by Pauwels (2017) most probably referred to *D. congolensis*.

Dipsadoboa duchesnii (Boulenger, 1901)
A pregnant adult female caught by LC near Kinguélé in Komo Dept, Estuaire Prov., in October 2019 was kept in captivity and laid two eggs on 29 October. These eggs, incubated in Libreville at room temperature in a glass jar full of wet sand, hatched 87 days later. The dorsal color of the hatchlings was uniformly brown (Figure 5). The female and its hatchlings were released at the collection site. Although this snake species has been well documented from the Crystal Mounts (Pauwels, Kamdem Toham et al., 2002b), this is the first report from Crystal Mounts NP (Pauwels, 2016).

The subadult male MSNS Rept 288 was collected by PC on a branch a meter above the ground in the forest (0°34'16.7"N, 9°20'11.0"E) in the Arboretum Raponda Walker. Its main morphological characters are given in Table 1. On each side the Lor is fused with the single PreO. The temporal formula is 2+1+2 on the left, 1+1+2 on the right. The vertebral row is not distinctly enlarged. There is one additional half VEN on the right side between VEN 83 and 84, not included in the VEN count. This arboreal snake, common in Gabon, had not yet been recorded from the arboretum (Pauwels, 2016).

Figure 6. Live adult *Grayia ornata* in Lopé National Park, Ogooué-Ivindo Prov., central Gabon. Photograph by G. De Bruyne.

Grayia ornata (Barboza du Bocage, 1866)
On 12 July 2021 GDB encountered and photographed an adult ornate water snake in the Mindoubé River (0°06'50.27"S, 11°36'16.34"E), an affluent of the Lopé River, in the northern part of Lopé NP, Lopé Dept, Ogooué-Ivindo Prov. A large part of the posterior part of its body was hidden in the leaves covering the bed of this shallow river, while the anterior part of its body was exposed and reached the surface (Figure 6). This record confirms the presence of this snake in the NP, based so far on an undocumented record from a locality in the northern part of the park (0°09'36.0"S, 11°35'23.0"E) by Blanc and Frétey (2000).

An adult individual (Figure 7) was photographed on 1 December 2021 by ET at the camp of the Gorilla Protection Project (2°06'52.9"S, 14°04'08.4"E), within Plateaux Batéké NP, Haut-Ogooué Prov. It was active by day on the ground after a heavy rainfall, at 200 m W of the Mpassa River. This is the first record of the ornate water snake for the park. It is the second record for Haut-Ogooué Prov. and the first for Mpassa Dept (the first provincial record was made in 2019 by Pauwels, Morelle et al. in Lékédi Park, Lékoko Dept).

Hapsidophrys smaragdinus (Schlegel, 1837)
See under *Thelotornis kirtlandii*.

Philothamnus heterodermus (Hallowell, 1857)
The stomach of the adult male MSNS Rept 282, caught on an unknown date during the period November 2016 – March 2017 on the road to Ipassa Research Station (at ca. 0°31'15.2"N, 12°47'58.3"E), Ivindo NP, Ivindo Dept, Ogooué-Ivindo Prov., contains an adult long-fingered squeaker, *Arthroleptis macrodactylus* Boulenger, 1882. The frog, which had been ingested head first, has a SVL of 27 mm, and is still preserved in ethanol in the same jar as its predator. This frog species was previously known from Gabon under the name *Arthroleptis poecilonotus* Peters, 1863 or *A.* aff. *poecilonotus* (Dewynter and Frétey, 2019). This is the first record of predation by this snake species on this frog. MSNS Rept 282 has a temporal formula of 2+1 (left) / 1+1 (right). Its dorsal scale row reduction from 15 to 11 occurs through a fusion of rows 3 and 4 above VEN 82/86 and of rows 5 and 6 above VEN 91/91; more morphological data are provided in Table 1. This snake species is already well known from Ivindo NP (Carlino and Pauwels, 2015).

Figure 7. Live adult *Grayia ornata* in Plateaux Batéké National Park, Haut-Ogooué Prov., southeastern Gabon. Extralabials, typical of this species, are visible under the 5th and 6th supralabials. Photograph by E. Theleste.

Figure 8. Adult *Thelotornis kirtlandii* in Loango National Park, Ogooué-Maritime Prov., western Gabon. The snake is flicking its tongue, which is two-colored, with a red basis and a contrasting black furca. Photograph by E. Theleste.

Figure 9. Adult *Thelotornis kirtlandii* preying on an adult *Hapsidophrys smaragdinus* in the Crystal Mounts, northwestern Gabon. Photograph by D. Zipper.

Thelotornis kirtlandii (Hallowell, 1844)
An adult Kirtland's tree snake (Figure 8) was photographed by ET on 5 April 2016 along a swamp (2°04'55.3"S, 9°29'33.1"E) about 6 km E of Tassi in Loango NP, Etimboue Dept, Ogooué-Maritime Prov. While being closely approached and photographed, the snake remained calm and did not seem to pay any attention to ET. This arboreal snake was already known from the buffer zone of the park (Pauwels, 2016), but this is the first record from the park's core area.

On 2 October 2021 DZ photographed an adult individual preying on an adult *Hapsidophrys smaragdinus* in a forested area (0°27'27.0"N, 10°16'37.7"E) along the Abangassa River in the Crystal Mounts, Komo Dept, Estuaire Prov. (Figure 9). Only a couple of predation cases by *Thelotornis kirtlandii* on snakes are known, among them one on *Hapsidophrys smaragdinus* from southern Nigeria (Akani et al., 2002). New locality record for both snake species, which are both very common in the Crystal Mounts (records for both species were provided by Pauwels, Kamdem Toham et al., 2002b; Pauwels, Biyogho Bi Essono et al., 2017).

Elapidae
Naja annulata Buchholz & Peters in Peters, 1876
An article in the Gabonese newspaper *L'Union* (Moussavou, 2022) reported that a young Congolese fisherman died following the bite of a snake entangled in his fishing net in the Voungou River, at eight km from Dilemba, Mongo Dept, Nyanga Prov. The fisherman was bitten on the thumb while he was holding the snake and trying to kill it with a stone; he is said to have died within a few minutes after the bite, just after saying he was feeling very cold. The snake was not identified in the article, not even by a vernacular name, but a color photograph was provided, showing a dead snake in ventral view, exhibiting regularly-spaced double black rings on a yellowish belly. This ventral pattern is typical of *Naja annulata*, and not shown by any other snake in Gabon. Based on the information provided in the newspaper's article, the approximate location of the site where the fatal envenomation occurred is 3°20'32.4"S, 11°28'55.8"E. Gabonese records of the ringed water cobra are few. The species has been recorded within Nyanga Prov. from Doumvou and Mayumba in Basse-Banio Dept (Pauwels and Lavoué, 2004; Pauwels and Vande weghe, 2008; Pauwels, Albert et al., 2017; Pauwels, Gillet et al., 2018; Pauwels, Bamba Kaya et al., 2020). The bite case reported here thus represents a new Dept record for this cobra species, and the first record from the Voungou River.

Lamprophiidae
Mehelya poensis (Smith, 1849)
MSNS Rept 284 was caught on 17 November 2017 at 23:25 on the forest floor (0°34'30.0"N, 9°19'58.0"E) in the Arboretum Raponda Walker, Komo-Mondah Dept, Estuaire Prov. Its main morphological characters are given in Table 1. The length and width of its frontal scale are equal (3.1 mm). Its temporal formula is 1+2+3 on both sides. Its umbilical scar is still visible on VEN 218-221. First record for the arboretum (see the other reptile records for the arboretum in Pauwels, 2016; Pauwels, Braun et al., 2017). It was found in direct proximity to an adult *Hemidactylus muriceus* Peters, 1870 (MSNS Rept 285).

Natricidae
Hydraethiops melanogaster Günther, 1872
We dissected three museum-preserved specimens recorded from the Crystal Mounts by Pauwels, Kamdem Toham et al. (2002b). The stomach of the female individual RBINS 16258 (SVL 436 mm, TaL 105 mm) from Assok (0°43'12"N, 10°21'36"E, 550 m asl), Haut-Komo Dept, Woleu-Ntem Prov., contains two specimens of the weakly electric fish *Paramormyrops batesii* (Boulenger, 1906) (Osteoglossiformes: Mormyridae), both ingested head first (Figure 10). The smallest mormyrid specimen (standard length ca. 83.9 mm, TL 90.4 mm) is still in relatively good condition, but the anterior half of the largest specimen,

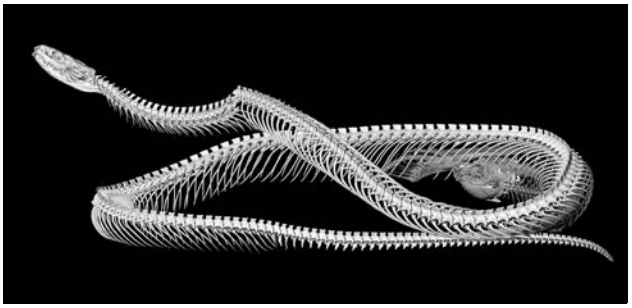

Figure 10. Micro-CT tomogram of a preserved female *Hydraethiops melanogaster* (RBINS 16258) from Assok, Woleu-Ntem Prov., northwestern Gabon. Note the two mormyrid fish prey items on the right. Scan by C. d'Udekem d'Acoz.

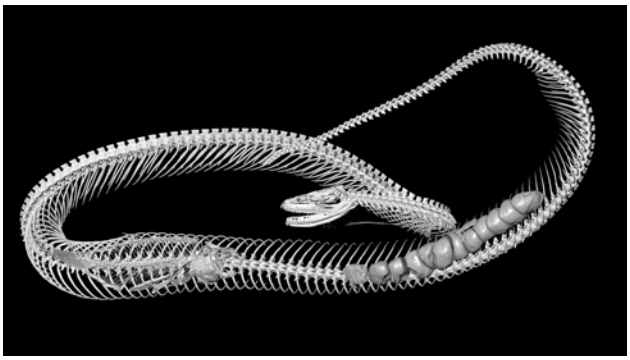

Figure 11. Micro-CT tomogram of a preserved adult, pregnant female *Hydraethiops melanogaster* (RBINS 16259) from Assok, Woleu-Ntem Prov., northwestern Gabon. Note the cichlid fish prey item on the left and the dozen eggs on the right. Scan by C. d'Udekem d'Acoz.

Figure 12. Live *Hydraethiops melanogaster* in Plateaux Batéké National Park, Haut-Ogooué Prov., southeastern Gabon. Photograph by E. Theleste.

ingested first, is digested. The smaller specimen could be easily identified using the key provided in Hopkins et al. (2007). The traits that could still be observed on the larger specimen were in agreement with this identification. The stomach of another *Hydraethiops* female (RBINS 16259; SVL 500 mm, TaL 108 mm), from the same locality, contains a juvenile Nile tilapia *Oreochromis niloticus* (Linnaeus, 1758) (Cichliformes: Cichlidae), ingested head first, with a standard length of 52.6 mm and a TL of 72.3 mm (approximate measurements, due to the partly digested condition of the fish). The same female snake is pregnant and contains 12 eggs at an early stage of development, located between VEN 106 and 129 (Figure 11). The fish prey could be identified based on the form and the dentition of the pharyngeal bones (densely set lower pharyngeal bone with a long stalk), on the high scale counts around the caudal peduncle (16) and along the lateral line (31), and on the pattern of regular vertical bands on the caudal fin (Stiassny et al., 2008). The stomach of the female *Hydraethiops* RBINS 16260 (SVL 367 mm, TaL 90 mm) from Nzogbour (0°55'36"N, 10°36'17"E, 580 m asl), Haut-Komo Dept, Woleu-Ntem Prov., contains an African red-finned barb *Enteromius camptacanthus* (Bleeker, 1863) (Cypriniformes: Cyprinidae). The latter fish specimen, still in good condition and separately registered as RBINS 28036, had been ingested tail first. This fish species had been listed under the name *Barbus camptacanthus* from the Crystal Mounts NP by Fermon et al. (2016). No specific diet records were available so far in Gabon for this freshwater snake species, known to feed elsewhere on amphibians and fish, but only very few records are globally available (Chippaux and Jackson, 2019).

ET encountered an individual near the camp of the Gorilla Protection Project (2°06'52.9"S, 14°04'08.4"E) at 200 m from the Mpassa River on 24 December 2021 and another on the bank of the Mpassa River (2°06'55.4"S, 14°04'13.1"E; Figure 12) on 18 October 2022, in Plateaux Batéké NP, Mpassa Dept, Haut-Ogooué Prov. First records for the park and for the province (Pauwels and Vande weghe, 2008; Pauwels, 2016).

We take this opportunity to provide morphological data (see Table 1) on an unpublished specimen, MSNS Rept 297, caught during the period November 2016 – March 2017 on the road to Ipassa Research Station (at ca. 0°31'15.2"N, 12°47'58.3"E), Ivindo NP.

Table 1. Morphological data for preserved snakes from Gabon. NA = not available/not assessed. For the other abbreviations see Materials and Methods.

Species / Specimen	Sex	SVL (mm)	TaL (mm)	DSR	PV+VEN	A	SC	SL	IL	Lor	PreO	SubO	PoO	AT
Atractaspididae														
Polemon collaris														
MSNS Rept 295	M	464	36	15-15-15,U	2+201,U	D	22,D,U	NA	7(4)/7(4)	0/0	NA	0/0	NA	1/1
Colubridae														
Dipsadoboa duchesnii														
MSNS Rept 288	M	382	130	17-17-13,U	1+206,K	S	112,D,U	8(3-5)/8(3-5)	10(5)/10(5)	0/0	1/1	0/0	2/2	2/1
Philothamnus heterodermus														
MSNS Rept 282	M	419	186	15-15-11,U	1+148,K	S	92,D,K	9(4-6)/8(3-5)	10(5)/10(5)	1/1	2/2	0/0	2/2	2/1
Lamprophiidae														
Mehelya poensis														
MSNS Rept 284	Juv.	299	86	17-15-15,K	2+244,K	S	114,D,K	7(3-4)/7(3-4)	8(5)/8(5)	1/1	1/1	0/0	2/2	1/1
Natricidae														
Hydraethiops melanogaster														
MSNS Rept 297	Juv.	156	42	23-21-19,K	0+149,U	D	55,D,U	10(5-6)/10(5-6)	11(5)/10(5)	1/1	1/1	0/0	2/2	1/1

Figure 13. Live juvenile *Psammophis mossambicus* in Iguéla, Ogooué-Maritime Prov., western Gabon. Photograph by L. J. T. White.

Psammophiidae
Psammophis mossambicus Peters, 1882
A juvenile individual (Figure 13) was encountered by LG and LJTW on 15 August 2022 in Iguéla, Etimboué Dept, Ogooué-Maritime Prov. New locality record (Pauwels, Bamba Kaya et al., 2020). Within Loango NP, this sand snake species had previously only been recorded from the southern part of the park in Ndougou Dept by Pauwels, Branch et al. (2004, under *Psammophis* cf. *phillipsii*).

Viperidae
Atheris squamigera (Hallowell, 1856)
A turquoise individual (Figure 14) was photographed on 15 November 2015 by ET on a tree on the border of Ozouga camp (2°07'04.8"S, 9°28'55.3"E) of the Loango Chimpanzee Project, about six km SE of Tassi, in Loango NP, Etimboue Dept, Ogooué-Maritime Prov. This individual remained on the same branch for 48 hours. Although this viper species is common throughout Gabon, it had not yet been recorded from Loango NP (Pauwels, Branch et al., 2004; Pauwels, 2016). This brings the total number of reptile species recorded from Loango NP to 46 (see the 45th record by Pauwels, Pauly et al., 2020).

Bitis arietans (Merrem, 1820)
In the late afternoon of 15 March 2021 ET encountered a puff adder (Figure 15) in a savanna (2°06'52.9"S, 14°04'08.4"E) near the camp of the Gorilla Protection Project in Mpassa Dept, Plateaux Batéké NP, Haut-Ogooué Prov. The viper did not show any sign of aggressiveness while being photographed at close range. New locality record for this medically important species, still documented in Gabon only by a handful of records in Nyanga and Haut-Ogooué provinces (Pauwels, Morelle et al., 2019).

Figure 14. Live turquoise *Atheris squamigera* in Loango National Park, Ogooué-Maritime Prov., western Gabon. Photograph by E. Theleste.

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Figure 15. Live *Bitis arietans* in Plateaux Batéké National Park, Haut-Ogooué Prov., southeastern Gabon. Photograph by E. Theleste.

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Opportunistic Records of Herpetofauna in Mainland Puerto Rico

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Abstract

Island ecosystems often have unique varieties of endemic wildlife unrepresented in their mainland counterparts. One great example of this is the herpetofaunal variation seen in Puerto Rico. Here we report on incidental data of occurrence on all species of reptiles and amphibians encountered throughout three separate trips. We did not employ any systematic survey techniques; we relied on traditional field methods to seek out herpetofauna, and did not interact with the animals. Following two trips during the summer of 2021 and one trip during 2022 we compiled this observational data into lists and then compared observed herpetofaunal diversity within each locality. We documented the highest species abundance in the Arecibo municipality with 14 different species, while San German appeared to show the least amount of opportunistic herpetofauna, with only three species observed. We observed two species of Endangered squamates and one lizard listed as Vulnerable.

Although we did not use extensive methods of detecting herpetofauna, we believe that this opportunistically collected information stands as a good example of herpetofaunal species in Puerto Rico that hold stable enough populations to be visualized within an incidental setting. We acknowledge this data was not part of a formal survey effort but may prove to be useful as a documentation of the reptiles and amphibians of Puerto Rico.

Introduction

Here, we document opportunistic observations of herpetofauna present on the Puerto Rican mainland. Our informal surveys, spanning two trips during the summer of 2021 and one trip during 2022, accounted for every observed species of herpetofauna present during the day and night throughout three trips to the island territory of the United States. Our records encompass towns and electoral districts of San Juan, Florida, Arecibo, Rio Grande, Guanica, Isabela, Orocovis, and San German. Through these incidental observations, we document species of conservation concern, as well as invasive or introduced species.

Many islands around the world display high levels of biodiversity and speciation, as island taxa face different pressures than species associated with mainland habitats and have opportunities to fill diverse niches and often speciate rapidly (Simberloff, 1974). As a result of this, high biodiversity of related taxa is common in island ecosystems. Although small, the territory of Puerto Rico showcases a variety of herpetofaunal species, with approximately 19 native amphibians and 52 native reptiles, and the island occupies an area of 8,900 km², making it the smallest of the four islands known as the Greater Antilles (Joglar et al., 2011). In contrast, the island of Hispaniola possesses 65 species of amphibian and 146 species of reptile (Powell et al., 1999). One reason for this high diversity is that Hispaniola was formed by the joining of two major elements: paleoislands known as the South Island (area 9,550 km²) and the North Island (area 67,700 km²) (Schwartz, 1980). Intermediate in size between Hispaniola and Puerto Rico is Jamaica, with an area of 11,500 km². While Jamaica is larger than Puerto Rico, it possesses less herpetofaunal diversity, with only 66 species compared to Puerto Rico's 71 species of reptile and amphibian (Wilson, 2011).

Puerto Rico also possesses an assortment of satellite islands surrounding its mainland. One such group of locales is the U.S. and British Virgin Islands to the east of Puerto Rico. The U.S. Virgin Islands are mostly located on the Puerto Rican shelf with one outlier on a separate southern shelf (Platenberg, 2007). Within the U.S. Virgin Islands, there are 24 native species residing on these major islands and cays, with a total land mass comprising 353 km², significantly smaller in both size and biodiversity in contrast to what is seen in Puerto Rico (Platenberg, 2006). As the British Virgin Islands follow a similar biogeographical makeup to the U.S. Virgin Islands, they possess many similar species. Additionally, they have a total area of 153 km² when all land masses are taken into consideration (Gore, 2007). Overall, there are 34 total reptile and amphibian species present on the British Virgin Islands, with 6 potentially being introduced or cryptogenic in origin (Perry and Gerber, 2006).

Despite the fact that Puerto Rico and its surrounding islands are small in geographic area, they exhibit significant assemblages of biomass and density. For instance, small lizards existing in an island biotope are observed to have higher population densities than squamate populations seen on larger islands or the mainland (Rodda and Dean-Bradley, 2002). Considering that herpetofaunal density and endemism are significantly higher on

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Anolis evermanni.

islands in comparison to mainland ecosystems, island populations are at a substantially higher degree of risk than their mainland counterparts, due in part not only to restricted habitat ranges but also to specializations that come from evolving in isolation (Purvis et al., 2000). Although populations for most species are limited, certain taxa are exceptionally successful within an island biotope and may climb to comparatively high population densities. One such group is the genus *Anolis* (Schoener and Schoener, 1980).

Like other island species that are famous for their diversity, *Anolis* are widely studied for their unique adaptations within island environments (Pinto et al., 2008). The adaptive radiation of *Anolis* allows species within the genus to have access to individual habitat niches that would otherwise be taken in a mainland environment (Losos et al., 2006). As a genus, *Anolis* carries a high degree of phenotypic plasticity and can adapt to a variety of different habitat conditions. Consequently, *Anolis* has experienced adaptive radiation four times throughout the Greater Antilles (Huie et al., 2021). In conjunction with the phenotypic plasticity of *Anolis*, islands harbor ideal temperatures for the thermoregulatory behavior of this genus, as the higher overall temperatures of the Greater Antilles in comparison to the Central American mainland have allowed Caribbean *Anolis* to embrace the Bogert effect, otherwise known as behavioral inertia, that would stimulate the adaptive radiation of a thermoregulatory species (Salazar, 2019). In terms of species diversity, *Anolis* is prolific throughout the Puerto Rican mainland and satellite islands, with a large portion of squamates on the island belonging to this genus. Species inhabiting Puerto Rico include *Anolis cooki*, *A. desechensis*, *A. krugi*, *A. poncensis*, *A. stratulus*, *A. cristatellus*, *A. evermanni*, *A. monensis*, *A. pulchellus*, *A. cuvieri*, *A. gundlachi*, *A. occultus*, and *A. roosevelti* (Joglar et al., 2007). As is thecase for *Anolis*, the closed island ecosystem of Puerto Rico allows for many different sizes and forms of herpetofauna—not just squamates but amphibians as well. An example of this can be seen within the frog genus *Eleutherodactylus*.

The Coqui frogs of *Eleutherodactylus* are iconic within Puerto Rico, and their calls can be heard at nighttime throughout much of the island. Puerto Rico is home to 18 species of amphibians that are endemic to the island territory, with 16 species being frogs of the genus *Eleutherodactylus* (Fogarty et al., 2001). *Eleutherodactylus* have been present in Puerto Rico since

Anolis krugi.

the Oligocene, approximately 29 Ma, and were able to quickly colonize and radiate throughout the island (Blackburn et al., 2020). Like other species of Caribbean fauna, *Eleutherodactylus* have engaged in replicate radiations. Moreover, they were able to colonize many islands throughout the Caribbean islands and cays, resulting in over 160 species of frogs in this genus inhabiting this region (Dugo-Cota et al., 2019). Species of this genus inhabiting Puerto Rico are *Eleutherodactylus antillensis*, *E. cooki*, *E. gryllus*, *E. karlschmidti*, *E. portoricensis*, *E. wightmanae*, *E. brittoni*, *E. coqui*, *E. hedricki*, *E. locustus*, *E. richmondi, E. juanriveroi*, *E. cochranae*, *E. eneidae*, *E. jasperi*, *E. monensis* and *E. unicolor* (Joglar et al., 2007). Although some species such as *E. coqui* are common, other species such *E. locustus*, *E. unicolor* and *E. wightmanae* are listed as endangered, and monitoring projects are integral towards consistent estimates of population dynamics (Villaneuva-Rivera, 2007).

Another unique endemic to Puerto Rico is *Peltophryne lemur*, also known as the Puerto Rican crested toad. This species of amphibian is listed as Endangered on the IUCN Red List of Threatened Species, as of an August 2020 assessment (IUCN SSC Amphibian Specialist Group, 2021). Although this species is now endangered and sightings are rare, it was once commonly found throughout the island (Paine et al., 1989).

Although not as commonly seen as the anoles of Puerto Rico, other squamates are also present. The snakes *Chilabothrus inornatus* and *Borikenophis portoricensis* are both frequently observed throughout the island. Although *C. inornatus* is observed somewhat commonly, it is still federally listed as Endangered with little signs of population recovery (Puente-Rolón et al., 2013). Fortunately, *B. portoricensis* is listed as least concern by the IUCN and serves the unique role on the island of being a mildly venomous snake that preys primarily on lizards (Weldon

Eleutherodactylus antillensis.

Chilabothrus inornatus.

and Mackessy, 2010). Puerto Rico is also home to several species of teiid lizards that reside within the informal *exsul* group of the Ameiva family. Of these lizards, *Pholidoscelis exsul, P. wetmorei,* and *P. polops* inhabit Puerto Rico (Hower and Hedges, 2003). Additionally, the endangered Puerto Rican skink, *Spondylurus nitidus* is present on the island and is sometimes seen residing in humid limestone forests (Sanchez, 2013).

Alongside the many species of terrestrial herpetofauna, aquatic turtles of the terrapin family may be found in Puerto Rico. *Trachemys stejnegeri* is present in many bodies of freshwater in Puerto Rico (Seidel, 1988), alongside reported populations of *Trachemys scripta elegans* introduced from the mainland United States. Other testudines present in Puerto Rico include many species of sea turtles. *Chelonoidis carbonaria* has also been reported to be present on the island; however, it is debated as to whether this is due to anthropogenic means or natural distribution (Vinke et al., 2008).

Whilst Puerto Rico is home to many species of endemic herpetofauna, several exotic species have found their way to the island through human introduction. One such species is *Iguana iguana*, which is prolific and widespread throughout the island's many different ecosystems (Lopez-Torres et al., 2012). Another example of a large exotic species that has been introduced to Puerto Rico's wetlands is *Caiman crocodilus*, which for over 50 years has become an established apex predator within the Tortuguero Lagoon Natural Reserve (Bontemps et al., 2016).

Along with large invasives, small species of herpetofauna also have colonized Puerto Rico's ecosystems. For example, *Hemidactylus mabouia* has made its way to the Caribbean from the Mediterranean due to human intervention (Martínez Rivera et al., 2003). While this and other species of invasives have inhabited Puerto Rico for relatively long periods, there have been minimal studies to observe whether the presence of introduced species has further impacted the population dynamics of endemic and endangered Puerto Rican herpetofauna. However, observational surveys between substantial hurricane events can lead to unique opportunities to check how island species can tolerate changes due to anthropogenic habitat alteration (Avilés-Rodríguez et al., 2021).

Pholidoscelis exsul.

Methods and Results

Through three opportunistic surveys of herpetofauna on the Puerto Rican mainland, we detected a total of 29 different confirmed species, with two specimens of unidentified colubrid, and one probable hybrid *Trachemys*. Arecibo had the largest amount of these records, with 14 unique species. Out of these animals, the endangered *Chilabothrus inornatus* was detected during guided tours with local collaborators as well as on the authors' own accord. *C. inornatus* was seen in three different municipalities and observed around cave systems, on roads, and under artificial cover. Regarding the animal found under cover, an opaque snake roughly 1 m long was uncovered under a piece of sheet tin sitting atop concrete. The temperature under the tin was easily over 38°C. Three species of non-indigenous species were also detected, being *I. iguana*, *Hemidactylus mabouia*, and *Rhinella marina*.

The fewest species were seen within the municipality of San German, with a total of four species being opportunistically detected through one nighttime survey and two hikes. Many *Eleutherodactylus coqui* were seen during nighttime rain, along with many *Anolis cristatellus* and one large *Pholidoscelis exsul* in the morning. *Hemidactylus mabouia* was also seen.

Other noteworthy observations include the endangered *Spondylurus nitidu*s which was seen in the municipality of Isabela. Although information on the status of this enigmatic species is difficult to come by, most sources attribute the population decline of this species to the invasive Indian mongoose, *Herpestes edwardsii* (Hedges and Conn, 2012). Also observed was the vulnerable ameiva species, *Pholidoscelis wetmorei*,

Spondylurus nitidus.

Iguana iguana.

which was seen near the town of Guanica.

Non-native herpetofaunal presence included *Iguana iguana*, which was seen in San Juan, Florida, Arecibo, and Rio Grande, as well as *Osteopilus septentrionalis* and *Rhinella marina*, which were seen in Florida. *R. marina* was also seen in Arecibo, and *Hemidactylus mabouia* was observed in all eight localities visited.

Unidentified colubrids were seen in Rio Grande and Isabela, and a large unidentified corpse of a constricting snake was seen in Aguadilla while moving from one study site to another, oncoming traffic of a busy road prevented further investigation of the species. Additionally, the shed of an unidentified arboreal snake was seen in a tree in Rio Grande.

Discussion

While our documentation did not follow any systematic technique for ensuring we could observe each species of herpetofauna within a certain locality, and we were greatly limited by time on each excursion, we believe that our occurrence data well represents herpetofaunal species that are present enough to be observed in an opportunistic survey whilst acknowledging each trip had different factors leading to different observations such as guided intel from locals and different authors of varying field experience making each trip.

While observations for some endangered species such as *Spondylurus nitidu*s were too infrequent to make any comment on population dynamics, observations for other species of concern such as *Chilabothrus inornatus* happened with enough occurrence to make a general statement that their populations may be somewhat stable.

Contrasting with some endemic species which appeared to have somewhat restricted distributions on the island, *Rhinella marina* was present in multiple localities. However, we are uncertain as to whether the presence of this large toad disrupts the overall trophic systems of Puerto Rico. This is because *Rhinella marina* fills an ecological niche that was not previously filled in Puerto Rico. Nonetheless, it is entirely possible that the presence of *R. marina* puts an additional pressure on the already limited populations of Puerto Rico's only native bufonid, *Peltophryne lemur*. With this in mind, it is reasonable to assume that *R. marina* may act as an invasive competitor with *P. lemur*, and the role that *R. marina* plays in the conservation implications of *P. lemur* is in need of assessment. Additionally, the overall role of *R. marina* in Caribbean ecosystems warrants further investigation.

Rhinella marina.

Contrary to the possible conservation concerns with adult *R. marina*, past studies suggest that their larvae are not a threat. Furthermore, the tadpoles of the only metamorphosing frog native to Puerto Rico, *Leptodactylus albilabris*, have increased rates of metamorphosis when exposed to tadpoles of *R. marina*. Moreover, the tadpoles of *L. albilabris* achieve a higher early mass when exposed to larval *R. marina*, and *L. albilabris* have been recorded consuming *R. marina* tadpoles (Flores-Nieves et al., 2013).

Although the impacts of adult individuals of *Rhinella marina* have been understudied in Puerto Rico, their impacts have been recorded on other island ecosystems. For instance, *R. marina* has been recorded as an invasive predator of the vulnerable *Chilabothrus subflavus* on the island of Jamaica (Wilson et al., 2011). With this in mind, we suggest that the possible impacts of *R. marina* on *Chilabothrus inornatus* be analyzed to obtain a more complete idea of introduced pressures on endemic squamate populations.

I. iguana was ubiquitous throughout the island and as adult iguanas are largely herbivorous, they also fill a previously unrealized niche in Puerto Rico. However, their juveniles could potentially compete with the endemic species of *Anolis*, particularly *A. cuvieri*, as insectivorous juveniles of *I. iguana* are of a similar size and follow similar natural behaviors. Further study of the ecological impacts of juvenile iguanas may uncover pressures placed upon indigenous species. Past density measurements of *I. iguana* in Puerto Rico have been recorded to be at overall insignificant values in terms of impact on endemic populations. Moreover, *I. iguana* has been determined to be omnivorous at all stages, meaning that it would be occupying a previously unrealized niche within Puerto Rican ecology (Arce-Nazario and Carlo, 2012). In addition, iguanas have been observed to capitalize upon prey items from a wide variety of different taxa and trophic levels, such as snails, insects, vegetation, and occasionally small mammals (Krysko et al., 2007). Furthermore, recent studies on Puerto Rican populations of introduced *I. iguana* have shown that they have begun consuming crabs of the genus *Uca* as a supplementary prey item (Govender

Antillotyphlops platycephalus.

et al., 2012). However, these observations are mostly following predation on smaller species of fauna, and their impacts as juveniles on *Anolis*, *Pholidoscelis*, *Spondylurus*, and *Sphaerodactylus* as competitors remains understudied. Although relationships between introduced populations of *I. iguana* and native herpetofauna require further examination in many localities, instances of *I. iguana* utilizing the burrows of burrowing owls have been observed in populations on Marco Island (Kyrsko et al., 2007). Iguanas in Puerto Rico could also potentially be in indirect competition with native fossorial species for habitat use. In addition, iguanas have been known to consume a combination of both exotic and native plants, with studies of this occurring in Puerto Rico, where it has been recorded that their consumption of invasive vegetation acts in spreading these species of flora, and they have a negative impact on native black mangroves (Govender et al., 2012). Because of this, there is potential for Iguanas to have an indirect negative effect on endemic populations of herpetofauna by destroying their habitat. Although all these observations suggest that iguanas have a negative impact on endemic species, they could also provide some benefits to the herpetofauna of Puerto Rico. For example, they have been observed consuming mammals in Florida (Krysko et al., 2007). For this reason, they may be able to consume an occasional mongoose that would otherwise be a threat to *Spondylurus nitidus*. Additionally, although iguanas have likely aided in the spread of some invasive species, their consumption of select native plants also allows them to spread native flora, which could allow for habitat use by arboreal species (Burgos-Rodríguez et al., 2016). Finally, although iguanas have an introduced presence in Puerto Rico, *Boa Constrictor* does as well. Because of this, there is a possibility that *B. constrictor* may provide some sort of population control, as they commonly consume I. iguana in their native environment (Swanson, 1950). However, these interspecific predation dynamics remain understudied in Puerto Rico.

Throughout our study, occasional sightings of unidentified snakes were noted. On two separate occasions, unidentified colubrids were observed. One in Isabela and the other in Rio Grande. Due to the opportunistic nature of our study, the unidentified colubrids were likely either *Borikenophis portoricensis* or *Magliophis exiguus* as these are the two active diurnal colubrids native to the island and are very common.

Additionally, the corpse of a large constricting snake was observed on the road on the way from San German to Isabela. Although the identity of the snake was not confirmed. There are a few possibilities as to what it could be. The first possibility is that it could be the endemic *Chilabothrus inornatus*, although after conversing with locals it was determined that road mortality for this species is not common despite the authors documenting at least one occurrence of a *C. inornatus* found dead on a road. Alternatively, *Boa constrictor* is common near where the corpse was found and thus is a potential candidate for the specimen we observed.

Overall, our observations on the Puerto Rican herpetofauna were able to document a wide variety of taxa from various ecosystems and localities. Even though our documentation followed various hurricane events and multiple species of invasive herpetofauna were observed and, likely, these hurricanes are not of substantial impact on the indigenous species. One possibility for this is that island organisms are adapted to respond to hurricane events, as tropical storms are common in these localities. As a result, herpetofauna such as *Anolis* have adapted over time to improve clinging ability and other phenotypic variations that would improve survivability in a hurricane event (Donihue et al., 2018). Furthermore, urbanization and habitat fragmentation are undoubtedly the number one force that threatens the endemic species of the island. Consequently, we hope that our report on Puerto Rico's herpetofauna will inspire future surveys as well as encourage more collaborative efforts of researchers from the mainland United States and our fellow citizens of Puerto Rico. We also hope to generate interest in studying and protecting overlooked island ecosystems and the unique speciation of endemic Caribbean herpetofauna. With many species of this region being of conservation concern, hopefully, a further understanding of the distribution and occurrence of Puerto Rican herpetofauna will inspire further conservation efforts.

Acknowledgment

We thank the territory of Puerto Rico for having a long-standing positive relationship with the natural world, and for allowing us to take part in observing the wildlife of this island and assist with conservation efforts with the wonderful species of wildlife that call this island home. We thank the locals of each area we document here as we received assistance ranging from technical herpetological intel to casual reporting of decent places to explore.

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Appendix

Table 1. *Anolis* species seen in Puerto Rican localities: SJ = San Juan, F = Florida, A = Arecibo, RG = Rio Grande, G = Guanica, I = Isabela, O = Orocovis; SG = San German.

Species	SJ	F	A	RG	G	I	O	SG
Anolis cooki					×			
Anolis cristatellus	×	×	×	×	×	×		×
Anolis cuvieri			×					
Anolis evermanni				×				
Anolis gundlachi				×				
Anolis krugi				×		×	×	
Anolis poncensis					×			
Anolis pulchellus			×			×	×	
Anolis stratulus			×			×		

Appendix (cont'd)

Table 2. Squamate species other than *Anolis* and turtle species seen in Puerto Rican localities: SJ = San Juan, F = Florida, A = Arecibo, RG = Rio Grande, G = Guanica, I = Isabela, O = Orocovis; SG = San German.

Species	SJ	F	A	RG	G	I	O	SG
Antillotyphlops platycephalus			×					
Borikenophis portoricensis	×		×					
Chilabothrus inornatus			×	×		×		
Hemidactylus mabouia	×	×	×	×	×	×	×	×
Iguana iguana	×	×	×	×	×			
Pholidoscelis exsul	×		×		×			×
Pholidoscelis wetmorei					×			
Sphaerodactylus grandisquamis			×				×	
Sphaerodactylus nicholsi					×			
Sphaerodactylus roosevelti					×			
Spondylurus nitidus						×		
Trachemys stejnegeri	×							
Trachemys stejnegeri (likely hybrid)	×							

Table 3. Amphibians seen in Puerto Rican localities: SJ = San Juan, F = Florida, A = Arecibo, RG = Rio Grande, G = Guanica, I = Isabela, O = Orocovis; SG = San German.

Species	SJ	F	A	RG	G	I	O	SG
Eleutherodactylus antillensis		×	×		×			
Eleutherodactylus brittoni							×	
Eleutherodactylus cochranae		×		×				
Eleutherodactylus coqui		×	×	×				×
Eleutherodactylus portoricensis				×				
Leptodactylus albolabris			×	×			×	
Osteopilus septentrionalis		×						
Rhinella marina		×	×					

Mexican Geographical Distribution Notes 7: First State Record of *Crotalus willardi* (Serpentes: Viperidae) from Nayarit, Mexico

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Resumen

Reportamos por primera vez para el estado de Nayarit a la serpiente de cascabel *Crotalus willardi*, así mismo extendemos la distribución conocida de la subespecie *Crotalus willardi meridionalis* hacía el suroeste.

Palabras claves: Distribución, Serpiente de cascabeles, Sierra Madre Occidental

Abstract

We report the rattlesnake *Crotalus willardi* from the state of Nayarit for the first time and we extend the known distribution of the subspecies *Crotalus willardi meridionalis* to the southwest.

Keywords: Distribution, Rattlesnakes, Sierra Madre Occidental

Crotalus willardi Meek, 1906, has a distribution stretching from southeastern Arizona and southwestern New Mexico south across the higher reaches of the Sierra Madre Occidental to west-central Zacatecas (see Campbell and Lamar [2004: Volume II] for a list of distribution references). It occurs in numerous outlier ranges in Sonora and Chihuahua, but appears to be restricted to the main portion of the sierra further south. The most recent list of published localities for the southern populations of *C. willardi* can be found in Lemos-Espinal et al. (2019) for Durango, and recently the species was reported from Sinaloa (Grünwald et al., 2023). This species has not previously been reported from Nayarit, despite suspicions that the habitat is continuous and that it might eventually be found in the state (C. Grünwald; J. Campbell, personal communication).

Herein, we report on an observation made August, 2019, in the central portion of the Sierra Madre Occidental in Nayarit. This area has been formerly referred to as "Sierra de Nayarit" (Goldman, 1951) and Sierra de Santa Teresa (colloquial). The identity of the individual in the submitted photographs was verified by Dr. Jacobo Reyes-Velasco.

Mexico: Nayarit: Municipio de El Nayar: Found on a rocky hillside adjacent to a mountain meadow, between the native Cora villages La Cieneguita and Lindavista, on the Mesa del Nayar – Santa Teresa Hwy., approximately 2.3 airline km S of Lindavista (22.37488°N, 104.813050°W; WGS 84; 2374 m elev). 09 August 2019. Uriel Hernández-Salinas and Fernanda Rodríguez-Gutiérrez. A photo voucher of the individual was deposited in The University of Texas Arlington, Digital Collection (UTADC 9894a–I), this specimen was collected and deposited in the Colección Regional de Anfibios y Reptiles de Durango (CRD 2420) and this observation was added to the iNaturalist platform as: https://www.inaturalist.org/observations/179761442. This snake was found alive during the day foraging amongst leaf litter on a rocky hill in pine-oak woodland. This is the first record of this species for Nayarit, the first record for the municipality, and the southernmost verifiable record of this species. It extends the known range of the species 62 km WSW of the vicinity of Canoas, Durango (see below). The closest

Figure 1. The *Crotalus willardi meridionalis* (CRD 2420; UTADC 9894) from Nayarit reported herein. **A**. Dorsolateral view in life (UTADC 9894c) of individual collected from between the native Cora villages La Cieneguita and Lindavista, on the Mesa del Nayar – Santa Teresa Hwy., approximately 2.3 airline km S of Lindavista, Municipio de El Nayar, Nayarit. **B**. Lateral view of head of same specimen (UTADC 9894i). **C**. Ventral view of head of same specimen (UTADC 9894h). All photographs by Uriel Hernández-Salina and María Fernanda Rodríguez-Gutiérrez.

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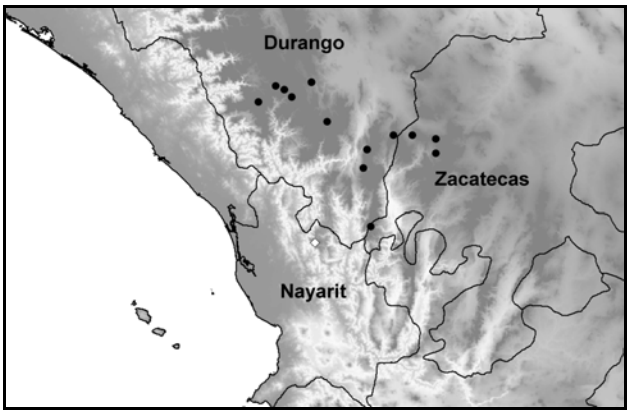

Figure 2. Known records of *Crotalus willardi meridionalis* in the southern Sierra Madre Occidental region of Durango, Zacatecas and Nayarit. Historical records are shown by circles; the new record reported herein is depicted by a diamond.

records of *C. willardi* with exact locality information are from approximately 95 km to the northeast at "12.5 km N of Los Charcos, Municipio de Mezquital, Durango (Lemos-Espinal et al., 2019) and from 137 km to the northeast at "48 km S of Durango," Municipio de Durango, Durango (Barker, 1992). The closest published locality for this species is the specimen USNM 46332, which was collected in 1897 by the Nelson-Goldman expedition on the Durango – Zacatecas border in the mountains between Huazamota, Durango, and San Juan Capistrano, Zacatecas (Goldman, 1951). This locality has been listed as originating from the "Sierra Madre" of Zacatecas (Klauber, 1949). However, the locality associated with this specimen is inexact, and it is not clear which state it originated from. The field notes from that expedition suggest that the specimen was probably collected from the vicinity of what is today known as Canoas (= Campamento Canoas), Durango, and in that case the specimen reported herein represents a 62-km range extension to the southwest. There is also an inexact record from the vicinity of Valparaiso, Zacatecas (Lara-Galván et al., 2020), which is approximately 58 km to the northeast. This record may refer to the same "Sierra Madre" record from Zacatecas reported by Klauber (1949, but see above).

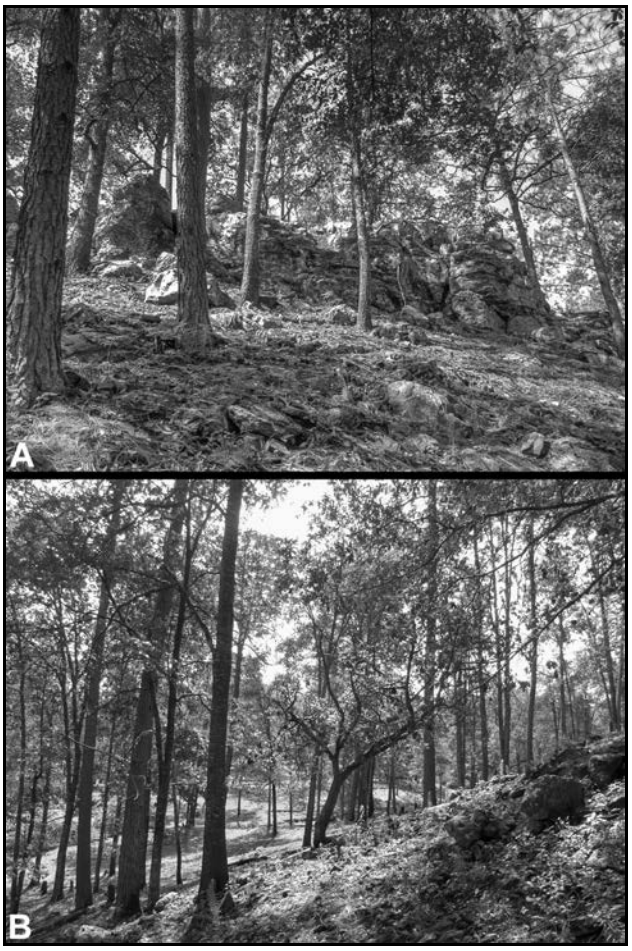

Figure 3. **A-B**. Habitat of *Crotalus willardi meridionalis* near La Cieneguita, on the Mesa del Nayar – Santa Teresa Hwy., approximately 2.3 airline km S of Lindavista, Municipio de El Nayar, Nayarit.

Acknowledgments

We thank Gregory Pandelis from University of Texas Arlington for his lightning-speed digital photo processing and for cataloguing the UTADC numbers. We are very grateful for the support from the local authorities of the village of Lindavista, Municipio de El Nayar, Nayarit, for allowing us to visit numerous surrounding localities and especially to the Cue family for providing us logistical support during our stay. We are indebted to Instituto Politécnico Nacional for providing funding to the senior author (UHS) for field work via the SIP projects 20190193 and 20230508. This specimen was collected under Mexican Scientific Collecting Permit #SGPA/DGVS/ 5671/19 issued to UHS by SEMARNAT. Jacobo Reyes-Velasco helped with verifying identifications, and reviewed the manuscript.

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Minutes of the CHS Board Meeting, August 15, 2023

A meeting of the CHS board of directors was called to order via Zoom at 7:34 P.M. Board member Kyle Houlihan was absent. CHS member Caitlin Monesmith was also present. Rich Crowley has assumed the duties of president and presided over the meeting. Minutes of the June 13 board meeting were read and accepted.

Officers' reports

Vice-president: Amelia Pollock will be taking over the position of vice-president.

Treasurer: Rich Crowley presented the July financial report.

Media secretary: Gabrielle Evans pleaded for earlier postings of information about shows and meetings.

Membership secretary: Mike Dloogatch read through the list of recent nonrenewals. Mike also mentioned that six months of *Bulletins*—January through June of 2022—have been added to the CHS website.

Sergeant-at-arms: Tom Mikosz reported a total attendence of 28 between the Junior Herpers and the general meeting on July 16.

Committee reports

Adoptions: Tom Mikosz will be taking over from Margaret Ann Paauw as adoption chairperson.

New business

Amelia Pollock will be able to store the CHS laptop in her office at the Nature Museum.

The meeting adjourned at 8:57 P.M.

Respectfully submitted by recording secretary Gail Oomens

NEW CHS MEMBERS THIS MONTH

Ali Baghdadi
Makana Bourque
Kolya Clayton
Scott R. Coles
Jefferson Davis III
Rebecca Gemperle

UPCOMING MEETINGS

Monthly meetings of the Chicago Herpetological Society begin at 2:00 P.M. on the third Sunday of each month. Please try to join us online or *in person* at the Notebaert Nature Museum, 2430 N. Cannon Drive, Chicago. The next meeting will take place on September 17. **Holly Carter**, a private breeder from Zionsville, Indiana, will be present in person to speak. Her topic will be "An Overview of Indigos and Cribos." Holly is a past president of the Chicago Herpetological Society. She currently serves as secretary for the Hoosier Herpetological Society.

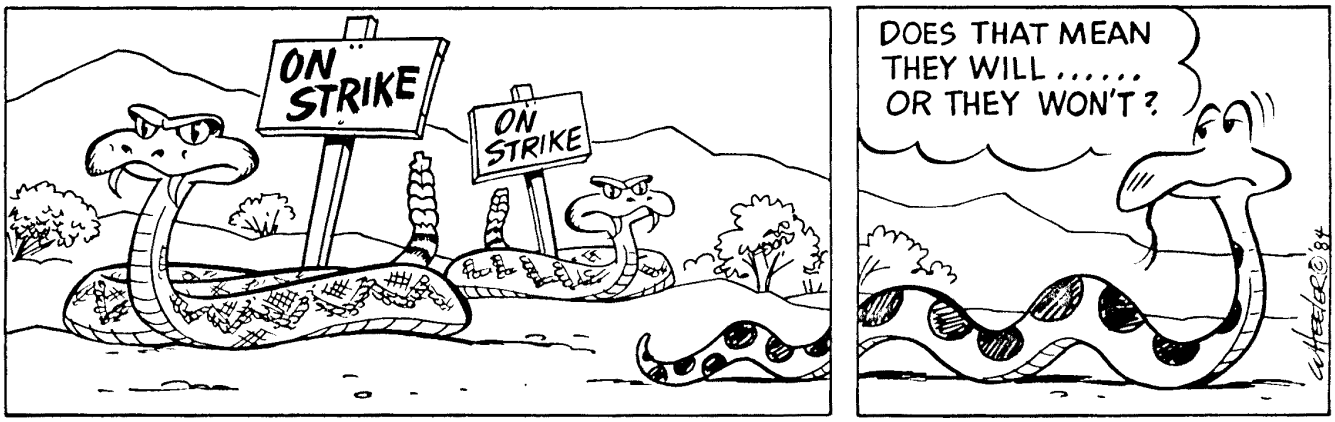
Rachel Bladow, last year's CHS vice-president, will be present in person to speak at the October 15 meeting. Rachel is a biologist at the American Zoo Association (AZA) Population Management Center at Lincoln Park Zoo. She will speak about "Population Management in AZA Zoos and Aquariums."

Please check the CHS website or Facebook page each month for information on the program. Information about attending a Zoom webinar can be found here:
<https://support.zoom.us/hc/en-us/articles/115004954946-Joining-and-participating-in-a-webinar-attendee->

Board of Directors Meeting

Are you interested in how the decisions are made that determine how the Chicago Herpetological Society runs? And would you like to have input into those decisions? The next board meeting will be held online. If you wish to take part, please email: rcrowley@chicagoherp.org.

THE ADVENTURES OF SPOT



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