
A SURVEY OF SNAKES IN THE PATTE D’OIE FOREST RESERVE (BRAZZAVILLE, REPUBLIC OF CONGO): AN URBAN SNAKE COMMUNITY IN CENTRAL AFRICA

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Abstract.—We surveyed snakes in the Patte d’Oie Forest Reserve (POFR), an urban forest remnant surrounded by the city of Brazzaville, Republic of Congo. We collected 96 specimens representing 17 species from 16 genera, nine subfamilies, and six families. Of these, the Spotted Night Adder, *Causus maculatus* (Viperidae), the Brown House Snake, *Boaedon perisilvestris* (Lamprophiidae), and the Stripe-backed Bush Snake, *Philothamnus dorsalis* (Colubridae), were the most abundant species. We found snakes primarily in terrestrial microhabitats (90%) but also in arboreal (7%) and aquatic (3%) ones. Comparison of the snake fauna of the POFR with other sites in Congo where surveys occurred indicates the snake fauna of POFR is most similar to the fauna from degraded habitat near the City of Pointe-Noire. We report here the first record of the Flower Pot Snake, *Indotyphlops braminus*, from Congo, though its presence is not surprising, and the first records from Brazzaville for the African Banded Snake, *Chamaelycus fasciatus*, and Dumeril’s Blind Snake, *Letheobia caeca*.

Résumé.—Nous avons observé des serpents dans la Réserve Forestière de la Patte d’Oie (RFPO), un vestige de forêt urbaine au centre de la ville de Brazzaville, en République du Congo. Nous avons recueilli 96 spécimens représentant 17 espèces, 16 genres, 9 sous-familles et 6 familles. Parmi ceux-ci, les espèces les plus abondantes étaient le *Causus maculé*, *Causus maculatus* (Viperidae), le Serpent gris des maisons, *Boaedon perisilvestris* (Lamprophiidae), et le Serpent vert à museau brun, *Philothamnus dorsalis* (Colubridae). Les serpents ont été trouvés principalement dans les microhabitats terrestres (90%) mais aussi dans les microhabitats arboricoles (7%) et aquatiques (3%). La comparaison de la faune ophidienne du RFPO avec celle d’autres sites au Congo où des serpents ont été étudiés indique que la faune ophidienne du RFPO est plus proche de celle signalée dans un habitat dégradé près de la ville de Pointe-Noire. Nous signalons ici le premier rapport du Serpent des pots de fleurs, *Indotyphlops braminus*, du Congo, bien que sa présence ne soit pas surprenante, et les premiers rapports de Brazzaville pour le *Chamaelycus à bandes*, *Chamaelycus fasciatus*, et le Serpent-ver à nez de Dumeril, *Letheobia caeca*.

Key Words.—biodiversity; ecology; herpetology; reptiles; Serpentes; species diversity

INTRODUCTION

The amphibians and reptiles of central Africa remain poorly known compared to other regions of the continent (Lawson and Klemens 2001; Tolley et al. 2016), and within central Africa, the herpetofauna of the Republic of Congo has been less studied than neighboring Cameroon (e.g., Difo et al. 2001; Foruekem 2002; Gonwouo et al. 2005; Herrmann et al. 2005; Chirio and Lebreton 2007) and Gabon (e.g., Burger et al. 2004; Pauwels and Vande Weghe 2008). The earliest herpetological studies from the Congo span a century (Mocquard 1887; 1889; Guibé 1946) with survey efforts intensifying during the 1960s (Ravisse 1960; Villiers 1966; De Witte 1967). Recent studies in forests in northern Congo (Jackson and

Blackburn 2007; Jackson et al. 2007) in the savannahs and forests of southern Congo in the 1980s-90s (Trape 1985; Trape and Roux-Estève 1990; Largen 1991; Largen and Dowsett-Lemaire 1991; Rasmussen 1991) and more recently (Jackson and Blackburn 2010; Zassi-Boulou et al. 2010, 2011; Boudzoumou et al. 2013; Rödel et al. 2015; Zassi-Boulou et al. 2018) have improved knowledge of Congolese herpetofauna.

Heavily disturbed habitats exposed to pressures from human population growth increasingly reflect the reality in tropical Africa (Akani et al. 2008). Biodiversity is considered by many authors (Wilson 1988; Auroi 1992; Lévêque 1994) a marker of ecosystem health and a key element in the capacity of species in a community to adapt to potential biotic and abiotic disturbances. Dajoz

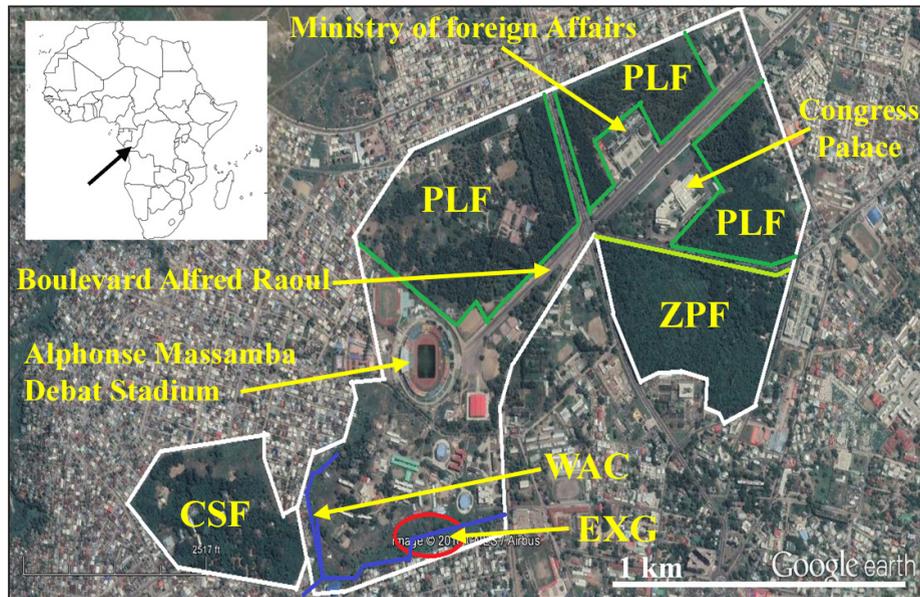


FIGURE 1. Aerial view of the Patte d’Oie Forest Reserve in the middle of Brazzaville, Republic of Congo (taken from: Google Earth Images 2009). Abbreviations are CSF = City of Science Forest; ZPF = Zoological Park Forest; PLF = Plantation Forest; EXG = Experimental Garden; WAC = Waterway. Inset (upper right) indicates the location of Brazzaville in Africa.

(1975) argues that anthropogenic activities, which affect ecosystems through abiotic factors, change the natural environment, which in turn induces changes in organismal life cycles. N’zala (1980) studied forest ecosystems in Brazzaville, capital city of the Republic of Congo, and found the urban forests experienced unprecedented degradation whereby some tree species had completely disappeared from the Brazzaville landscape, leading to an associated loss of biodiversity.

The Patte d’Oie Forest Reserve (POFR) is an urban forest relic in the center of, and completely surrounded by, the large and growing city of Brazzaville (current population more than 1.8 million). Since the establishment of the POFR in 1938, Brazzaville has expanded around the POFR, leaving only fragments of the original habitat, about 140 ha altogether. In the decades since the study by N’zala (1980), the effects of uncontrolled urbanization and construction, deforestation for the production of firewood or domestic products, followed by reforestation with exotic tree species have completely changed species composition of the POFR. The changes have potentially caused an imbalance in the phenology of certain species and even their demography. Reptiles and amphibians are among the native fauna remaining within the POFR. Thus, studying the species composition of the existing snake community in the POFR has the potential to offer insights into the remaining ecosystem in the POFR more broadly.

Insufficient knowledge of the herpetological diversity of most protected areas in Congo is a limitation and impediment for the management and conservation of tropical forest genetic resources. The same is true of the herpetofauna of the POFR, which, to our

knowledge, has never been the subject of a taxonomic inventory. Our study aims to improve knowledge of the herpetological biodiversity of the POFR by documenting the snake species present. High-quality community data, especially for snakes, which tend to have low detection probabilities, are rare in Africa. Our work can set the foundation for future biodiversity and community ecology studies, on which conservation initiatives may build.

MATERIALS AND METHODS

Study site.—Located 4° south of the equator, Brazzaville (4°16’4”S, 15°17’31”E) has a climate characterized by a rainy season from October to May and a dry season from June to September, with rainfall averaging 2 mm in July and 253 mm in November (Samba-Kimbata 1978). The temperature is fairly constant year-round at 22–27° C (<http://en.climate-data.org/>). The POFR was established in 1938 and encompassed about 240 ha and was named for the shape of the central region (patte d’oie in French = goose’s foot in English). The soil of the POFR is formed on poorly sorted sands derived from the Batéké Plateau with very low clay and trace mineral content, either Inkisi gravels/sands, which have a sandy-clay texture or on alluvia of the Congo River and its tributaries (Denis 1970). In general, these soils have a sandy-clay texture and are low in organic matter (Denis 1970). Surrounded by the city of Brazzaville, the POFR straddles the three Brazzaville arrondissements (administrative districts) of Makelekele, Bacongo, and Poto-Poto (Fig. 1). A major road bisects the POFR, and the Ngamboulou

River passes through the POFR before joining the Congo River (Fig. 1). Included within the POFR are a large stadium, the Congressional Palace, a forest on the site of the zoological park, and a forest on the site formerly occupied by the Office de la Recherche Scientifique et Technique Outre-mer (ORSTOM; Office of Overseas Scientific and Technical Research), an organization now replaced by the Institut de Recherche pour le Développement (IRD; Institute of Research for Development), a forested area occupied by university facilities and laboratories, including the herpetology lab occupied by some of the authors.

The vegetation of Brazzaville is composed mainly of remaining open-formation natural forests dominated by African Rosewood, *Millettia laurentii*. In addition to the natural forests, there are forests planted with non-native eucalyptus (*Eucalyptus* spp.), pines (*Pinus* spp.), and acacias (*Acacia* spp.). The Thatching Grass (*Hyporrhena diplandra*) savannahs of the POFR are dominated by two main species: Spiked Crinkleawn (*Trachypogon thollonii*) and African Custard-apple (*Annona senegalensis* ssp. *oulotricha*). For the purposes of sampling, we divided the POFR into five sites (Fig. 1): (1) The City of Science Forest (CSF) is degraded natural, terra firma forest, totaling 24.6 ha, dominated by Fried Egg Tree (*Oncoba welwitschii*), Knee of Little Sheep (*Palisota ambigua*), Oval False-leaf Buttonweed (*Spermacoce latifolia*), Hairy Croton (*Croton hirtus*), Guinea Grass (*Panicum maximum*), and *M. laurentii*; (2) The Zoological Park Forest (ZPF) is degraded natural terra firma forest, totaling 30.5 ha, dominated by *M. laurentii*, *O. welwitschii*, *P. ambigua*, and *P. maximum*; (3) The Plantation Forest (PLF) is made up of three areas totaling 80 ha combined, where the natural forest has been destroyed and replaced with a plantation of introduced trees; (4) The dominant trees are eucalyptus (*Eucalyptus* spp.) with the understory composed of Siamweed (*Chromolaena odorata*), Bristly Foxtail Grass (*Setaria barbata*), and *P. maximum*; and (5) The Experimental Garden (EXG) is a degraded grassy savannah totaling approximately 2.6 ha, dominated by Oldfield Grass (*Anthephora cristata*). A waterway (WAC), the Ngamboulou River, totals about 2.5 ha within the POFR. Aquatic plants associated with this site include Job's Tears (*Coix lacryma-jobi*), Southern Cutgrass (*Leersia hexandra*), and White Lotus (*Nymphaea lotus*). We identified microhabitats in which snakes we collected as follows: (1) in or on soil (So); (2) dead leaf litter (Ll); (3) trees (Tr); (4) grass (Gr); (5) dead tree trunks (Tt); (6) wetlands (We); (7) manioc patches (Pl); and (8) water (Wa).

Collecting methods.—We collected snakes opportunistically during general herpetological surveys over 21 mo from March 2007 to November 2008, with

intensive collecting occurring in alternate months, to ensure collecting occurred during wet and dry seasons. We sampled for snakes during the day and night using active searching and passive methods. Passive methods included pitfall traps with drift fences or wire mesh barrier traps for terrestrial species and gill nets placed in the river to catch aquatic species (Burger et al. 2006; Pauwels et al. 2006; Jackson et al. 2007). After capture, we euthanized snakes by intracardiac injection of xylocaine then fixed them in 10% formalin. We deposited voucher specimens in the IRSEN herpetology collection (Institut National de Recherche en Sciences Exactes et Naturelles), at the City of Science, Brazzaville.

Data analysis.— We calculated the species diversity of snakes for the POFR using the Shannon Diversity Index. The Shannon Index (H') takes into account both species richness (S) and evenness of species present:

$$H' = \sum_{i=1}^s - (P_i * \ln P_i)$$

Where: H' = the Shannon diversity index; P_i = fraction of the entire population made up by species i ; s = number of species encountered; \sum = sum from species 1 to species S (Shannon 1948; Spellerberg and Fedor 2003). We used Duellman's Faunal Similarity Index to compare the POFR to other sites in the Republic of Congo, drawn from the literature (Trape 1985; Jackson et al. 2007; Jackson and Blackburn 2007, 2010; Zassi-Boulou 2010; Zassi-Boulou et al. 2019). Duellman's faunal similarity index (K) compares lists of species found at two sites as follows:

$$K = 2C \times 100 / (A + B)$$

Where K = the percentage of species common to both groups; A = total number of species in group 1; B = total number of species in group 2; C = total number of species common to both groups. If K is > 50%, the compared groupings are considered to represent the same community (Bibby et al. 1998; Duellman 1999).

RESULTS

We documented the presence of 17 snake species, representing 16 genera, nine subfamilies, and six families (Table 1). The most abundant species was the Night Adder, *Causus maculatus*, followed by the House Snake, *Boaedon perisilvestris*, and the Bush Snake, *Philothamnus dorsalis* (Table 1). Of the five sites within the POFR, the CSF was the site with the highest number of individuals and species (14), followed by the EXG (six species), and ZPF (five species; Table 1). The sites with the fewest snakes were the PLF and WAC (Table 1). We primarily found snakes in terrestrial microhabitats,

TABLE 1. Number of individuals of each snake species collected in the Patte d'Oie Forest Reserve, Brazzaville, Republic of Congo, by study site (CSF = City of Science Forest, ZPF = Zoological Park Forest, PLF = Plantation Forest, EXG = Experimental Garden, WAC = Waterway) and by microhabitat type (So = soil, LI = leaf litter, Tr = trees, Gr = grass, Tt = tree trunks, We = wetlands, Pl = manioc patches, Wa = water).

	CSF	ZPF	PLF	EXG	WAC	So	LI	Tr	Gr	Tt	We	Pl	Wa	Total
COLUBRIDAE														
<i>Crotaphopeltis hotamboeia</i>	-	1	-	-	-	-	-	1	-	-	-	-	-	1
<i>Grayia smithii</i>	-	-	-	-	1	-	-	-	-	-	-	-	1	1
<i>Philothamnus dorsalis</i>	9	3	2	3	2	3	2	2	5	5	-	1	-	18
ELAPIDAE														
<i>Dendroaspis jamesoni</i>	1	1	-	-	-	-	-	2	-	-	-	-	-	2
<i>Naja annulata</i>	-	-	-	-	1	-	-	-	-	-	-	-	1	1
<i>Naja melanoleuca</i>	1	-	-	-	-	-	-	1	-	-	-	-	-	1
LAMPROPHIIDAE														
<i>Boaedon perisilvestris</i>	11	3	2	5	-	6	2	-	10	1	-	2	-	21
<i>Chamaelycus fasciatus</i>	1	-	-	-	-	1	-	-	-	-	-	-	-	1
<i>Lycophidion laterale</i>	5	-	-	-	-	2	1	-	2	-	-	-	-	5
<i>Polemon notatus</i>	2	-	-	-	-	1	1	-	-	-	-	-	-	2
<i>Prosymna ambigua</i>	1	-	-	-	-	-	-	-	1	-	-	-	-	1
<i>Psammophis phillipsii</i>	8	-	-	1	-	2	-	1	2	2	1	1	-	9
PYTHONIDAE														
<i>Python sebae</i>	1	1	-	-	-	1	1	-	-	-	-	-	-	2
TYPHLOPIDAE														
<i>Afrotrophops congestus</i>	1	-	-	1	-	2	-	-	-	-	-	-	-	2
<i>Indotyphlops braminus</i>	1	-	-	1	-	2	-	-	-	-	-	-	-	2
<i>Letheobia caeca</i>	1	-	-	-	-	1	-	-	-	-	-	-	-	1
VIPERIDAE														
<i>Causus maculatus</i>	22	-	1	3	-	10	3	-	6	2	-	5	-	26
Total	65	9	5	14	4	31	10	7	26	10	1	9	2	96
Species richness	14	5	3	6	3	11	6	5	6	4	1	4	2	17

with soil, grass, leaf litter, manioc patches, and dead tree trunks accounting collectively for 90% of snakes collected. Another 7% were arboreal and collected from trees, while the remaining 3% were in waterways or wetlands (river and ponds). We collected snakes during all months of the year, suggesting snakes are active year-round in the POFR, through both the rainy season and the dry season, with numbers collected ranging from three in December to 17 in March (Fig. 2). Below we provide detailed comments on each species collected in the POFR.

COLUBRIDAE: COLUBRINAE

***Crotaphopeltis hotamboeia* (White-lipped Herald Snake).**—We vouchered one individual (Table 1),

which made a threat display when initially approached in an open grassy area, and then fled and was eventually captured at the foot of a tree. Previous reports of *C. hotamboeia* from Congo include Rasmussen (1991), Trape and Roux-Estève (1995), Jackson et al. (2007), Jackson and Blackburn (2010).

***Philothamnus dorsalis* (Stripe-backed Bush Snake).**—We vouchered 18 individuals from the park (Table 1). Previous reports from the Congo include Rasmussen (1991), in Kouilou Department, Trape and Roux-Estève (1995), who reported *P. dorsalis* is particularly abundant in the parks and gardens of Brazzaville, where it willingly ventures into human habitations, and Zassi-Boulou et al. (2019) in the Lekoumou Department.

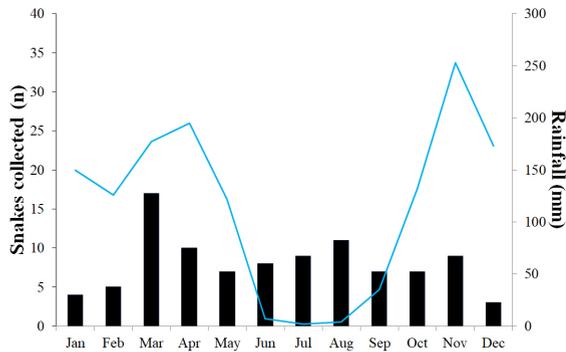


FIGURE 2. Numbers of snakes collected (black bars) during each month of the year in the Patte d'Oie Forest Reserve, Brazzaville, Republic of Congo, from March 2007 to November 2008, with average monthly rainfall for Brazzaville indicated by the blue line (source of rainfall data: <http://en.climate-data.org/>).

COLUBRIDAE: GRAYINIAE

Grayia smithii (Smith's African Water Snake).—

We vouchered one individual of this piscivorous species (Table 1). *Grayia* are robust semi-aquatic snakes, and all four species in the genus are known from the Congo (Trape and Roux-Estève 1995). Although non-venomous and generally not aggressive when handled, *G. smithii* is often mistaken for the Water Cobra, *Naja annulata*, which they resemble in general body shape and coloration. *Grayia smithii* and *N. annulata* have the same habitat and are often found at the same sites. Previous reports of *G. smithii* from Congo include Jackson and Blackburn (2007) from the Sangha Department and Jackson et al. (2007) from the Likouala Department.

ELAPIDAE

Dendroaspis jamesoni (Jameson's Mamba).—

We observed (by AZ) two individuals (Table 1) from trees about 4–5 m above the ground. We observed one specimen in the City of Science Forest and the other in the Zoological Park Forest. This species has been reported as abundant in forest habitat in Congo (Trape and Roux-Estève 1995). Rasmussen (1991) reported *D. jamesoni* from savannah habitat near the village of Tchissanga and Jackson and Blackburn (2010) reported a specimen crushed by a vehicle in the vicinity of Pointe-Noire.

Naja annulata (Ringed Water Cobra).—We vouchered one juvenile from a gill net from the Ngamboulou River. This semi-aquatic and piscivorous species is abundant and widely distributed in most of the rivers of the Congo (Rasmussen 1991; Chippaux and Jackson 2019), where it is readily encountered by fishermen (Jackson and Blackburn 2007; Jackson et al.

2007). The species sometimes uses the banks of rivers bordered by gallery forests (Trape and Roux-Estève 1995). They strongly resemble the harmless aquatic *Grayia*, which occurs in the same habitats. Previous reports from Congo include Rasmussen (1991) from the Kouilou Department, Jackson and Blackburn (2007) from the Sangha Department, and Jackson et al. (2007) from the Likouala Department.

Naja melanoleuca (Forest Cobra).—We vouchered one individual (Table 1) from an oil palm tree (voucher: IRSEN 00037). Broadly distributed, *Naja melanoleuca*, represents a complex of five species with two, the Central African Forest Cobra (*N. melanoleuca, sensu stricto*) and the Brown Forest Cobra (*N. subfulva*) occurring in the Congo (Wüster et al. 2018). Relevant scale counts and coloration for IRSEN 00037 are as follows: The dorsum is uniformly black. The venter is yellow anteriorly with nine discrete dark bands, then black posteriorly. Of the eight discrete dark bands, there are four main bands and four accessory bands. The first main dark band is four ventrals in width, extending from ventral 15–18. The last ventral of the last discrete dark band is the 60th ventral. There are 23 dorsal scale rows at the neck and 18 at midbody. There are 223 ventrals and 63 subcaudals. There are seven upper labials (the 3rd and 4th in contact with the eye), eight infralabials, the first four in contact with the anterior sublinguals, and no cuneates. There is one preocular, and there are three postoculars. The temporal formula is 1 + 2 on the right side, with five nuchals bordering the temporals, and 1 + 3 on the left side, with four nuchals bordering the temporals. All meristics are within the range of overlap between *N. melanoleuca (sensu stricto)* and *N. subfulva* (Wüster et al. 2018). Specimens of *N. melanoleuca (sensu lato)* collected in Likouala Department, Congo (Jackson et al. 2007) genetically include individuals of both *N. melanoleuca (sensu stricto)* and *N. subfulva* (Wüster et al. 2018). Collected within a few km apart, they are not clearly morphologically differentiable. It may be that genetic analysis is necessary to distinguish *N. melanoleuca (sensu stricto)* from *N. subfulva* from this region. Previous reports of *N. melanoleuca* from Congo include Rasmussen (1991) in Kouilou Department, Trape and Roux-Estève (1995) in Brazzaville, Jackson and Blackburn (2007) in Pointe Noire, and Jackson et al. (2007) in the Likouala Department.

LAMPROPHIIDAE: APARALLACTINAE

Polemon notatus (Peters's Snake-eater).—We vouchered two individuals (Table 1), one on soil and the other on leaf litter, both during active searching by day in the City of Science (vouchers: IRSEN 00086, 00087).

LAMPROPHIIDAE: LAMPROPHIINAE

***Boaedon perisilvestris* (Brown House Snake).**—We vouchered 21 individuals (Table 1) on the ground, in leaf litter, on grass, in dead tree trunks, in manioc patches, and very often near human dwellings. Recently described by Trape and Mediannikov (2016), *Boaedon perisilvestris* collections came from the City of science in Brazzaville in December 2013. They closely resemble *B. fuliginosus* (Brown House Snake) and *B. lineatus* (Striped House Snake), both previously known from the Congo. In *B. perisilvestris*, there is a dark brown dorsal coloration and a lack of clear lines on the sides of the body in juveniles. There is sometimes a pair of light lines on each side of the head, which usually have low contrast and disappear in adults. When present, the upper clear line is thick anteriorly between the eye and the internasals, where its width on the prefrontal is close to the width of the loreal but short and narrow posterior to the eye. There are 29–31 dorsal scale rows (Trape and Mediannikov 2016). The species is particularly abundant in forest-savannah mosaic zone in urbanized areas, often near human dwellings.

***Chamaelycus fasciatus* (African Banded Snake).**—We vouchered only one individual from the ground (Table 1). This small individual (snout vent length, SVL = 147 mm; total length, TL = 30 mm) was grey in color, with a dorsal pattern of black bands. It had 170 ventrals and 35 subcaudals. Of the seven upper labials, the 3rd, 4th, and 5th were in contact with the eye. The temporal formula was 1 + 2, and a loreal scale was present. Previous reports of *C. fasciatus* from Congo include Rasmussen (1991) from the Kouilou Department. Trape and Roux-Estève (1995) report that this species is quite common in the Mayombe and Chaillu forests; however, this is to our knowledge the first report of *C. fasciatus* from Brazzaville.

***Lycophidion laterale* (Flat Wolf Snake).**—We vouchered five specimens in the City of Science (Table 1) in front of the main administrative buildings, on the ground, in leaf litter on the grass. Previous reports from Congo include Rasmussen (1991) from the Kouilou Department and Jackson and Blackburn (2010) from Pointe Noire, where it was found to tolerate habitats highly disturbed by human activity.

LAMPROPHIIDAE: PSAMMOPHIINAE

***Psammodon philipsii* (Olive Sand Snake).**—We vouchered nine *P. philipsii* on trees, in grasses, on dead tree trunks, and in pools of water (Table 1). This diurnal species is broadly distributed in Africa. In Congo it is known from the central savannahs, from Mayombe

to Sangha, and forest clearings (Trape and Roux-Estève 1995). Previous reports from Congo include Trape (1985) and Rasmussen (1991) from the Kouilou Department, and Jackson et al. (2007) from the Likouala Department.

LAMPROPHIIDAE: PROSYMNINAE

***Prosymna ambigua* (East African Shovel-snout).**—We vouchered one individual in a pitfall trap (Table 1). This secretive, semi-fossorial species is the only species of *Prosymna* reported from Congo (Trape and Roux-Estève 1995). Previous reports from Congo include Rasmussen (1991) from the Kouilou Department.

PYTHONIDAE

***Python sebae* (African Rock Python).**—We documented the presence of two individuals, an adult and juvenile (Table 1). This broadly distributed species is considered a habitat generalist, observed in habitats ranging from savannah to flooded forest. Previous reports from Congo include Trape (1985), Rasmussen (1991), Trape and Roux-Estève (1995), Jackson et al. (2007), and Jackson and Blackburn (2007, 2010). *Python sebae* is heavily hunted for skin and meat and is listed in CITES Appendix II (Chippaux and Jackson 2019).

TYPHLOPIDAE: AFROTYPHLOPINAE

***Afrotyphlops congestus* (Blotched Blind Snake).**—We vouchered two individuals, one on a pitfall trap in the forest of the City of Science, the other on the ground in the Experimental Garden during active searching in the evening. This species is considered to be among the most abundant typhlopids in Congo and restricted to forest habitat (Trape and Roux-Estève 1995).

***Letheobia caeca* (Dumeril's Blind Snake).**—We vouchered one specimen (Table 1) in the evening, on the ground after rain. This species has been reported from Congo by Trape and Roux-Estève (1995) and by Wallach and Gemel (2018), but to our knowledge, this represents the first report of *L. caeca* from Brazzaville. *Letheobia caeca* can be distinguished from *L. praeocularis* (Flat-headed Blind snake) by having a preocular larger than the ocular, and from *L. acutirostrata* (Sharp-snouted Blind snake) by the horizontal orientation of the cutting edge of the rostral keel (Wallach and Gemel 2018).

TYPHLOPIDAE: ASIATYPHLOPINAE

***Indotyphlops braminus* (Flower Pot Snake).**—We vouchered two specimens (Table 1), one captured by

hand crawling on the ground near a tree in the morning, and the other found in a well by manioc farmers. This Asian species has been introduced to many other continents, including Africa, where it has rapidly spread. This species is distinctive (relative to other typhlopids present in Congo) in having 20 dorsal scale rows at midbody. This species is not previously known from Congo, but Trape and Roux-Estève (1995) include it in their list for the country as a likely introduced species.

VIPERIDAE

Causus maculatus (Spotted Night Adder).—We vouchered 26 individuals from three of the five sites within the POFR (Table 1). Most individuals were captured on the ground, in leaf litter, on grass, on dead tree trunks, and in manioc patches. Many were collected around and sometimes inside buildings (administrative offices, houses, etc.). *Causus maculatus*, reported by Rasmussen (1991) from the Kouilou Department and by Jackson and Blackburn (2010) from Pointe Noire, is a savannah species and habitat generalist that readily enters degraded forest, manioc patches, and other human-altered habitats but is absent from dense primary forest (Trape and Roux-Estève 1995).

Community similarity.—Studies of snakes have occurred throughout the Congo (Fig. 3). Duellman faunal comparison indices (*K*) for snake faunas documented at these sites vary from 8.33 to 42.42 (Table 2). These surveys differed in methodology, scale of sampling effort, season and year conducted, as well as geographical location and habitat type. Therefore, we might expect to find greater similarity of snake fauna between survey locations, which are geographically close together. A plot of faunal similarity against distance between sites, which partially controls for geographical proximity, shows that similarity of snake faunas decreases with distance (Fig. 4).

DISCUSSION

We documented 17 snake species in the POFR, a remnant of degraded forest surrounded by a city of almost 2 million inhabitants. Our collection of 96 individuals indicated species were not equally abundant, with three common species (*Causus maculatus*, *Boaedon perisilvestris*, and *Philothamnus dorsalis*) accounting for 68% of the individuals. The remaining 14 species include the first records from Brazzaville for *Chamaelycus fasciatus* and *Letheobia caeca* and the first record from Congo of *Indotyphlops braminus*. *Indotyphlops braminus* is a parthenogenetic Asian species which has been introduced to many parts of the world, and its presence, though not previously reported

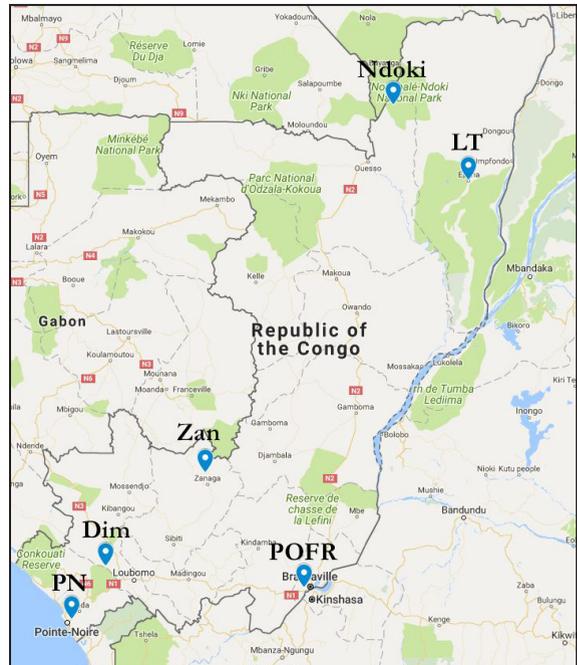


FIGURE 3. Locations where inventories of snakes were carried out in the Republic of Congo by us and other biologists. Abbreviations are POFR = Patte d'Oie Forest Reserve, Brazzaville (present study); PN = Pointe-Noire (Jackson and Blackburn 2010); Zan = Zanaga mine site (Zassi-Boulou et al. 2019); Dim = Dimonika (Trape 1985); LT = Lac Tété (Jackson et al. 2007); Ndoki = Nouabale-Ndoki National Park (Jackson and Blackburn 2007).

from Congo, is not surprising. Though rainfall fluctuates between rainy season and dry season in Brazzaville, we collected snakes in all months of the year, indicating snakes are active year-round in the POFR.

Several herpetofaunal surveys have been carried out at other locations in Congo, which may offer insight into the assemblage of snake species found at the POFR. Trape (1985) surveyed snakes at a research station in the Mayombe Forest near Dimonika, in the Kouilou Department. Jackson et al. (2007) surveyed within and just outside the Lac Tété Community Reserve (a protected area), in the Likouala Department. Jackson and Blackburn (2007) surveyed the herpetofauna

TABLE 2. Faunal similarity indices (*K*) comparing the Patte d'Oie Forest Reserve (POFR) snake fauna with other Congo sites. Abbreviations are PN = Pointe-Noire (Jackson and Blackburn 2010); Zan = Zanaga mine site (Zassi-Boulou et al. 2019); Dim = Dimonika (Trape 1985); LT = Lac Tété (Jackson et al. 2007); Ndoki = Nouabale-Ndoki National Park (Jackson and Blackburn 2007).

	POFR	PN	Zan	Dim	LT	Ndoki
POFR	0	42.42	20.00	19.35	33.33	24.00
PN		0	25.60	32.79	28.57	8.33
Zan			0	41.18	33.33	25.81
Dim				0	21.88	11.32
LT					0	22.22
Ndoki						0

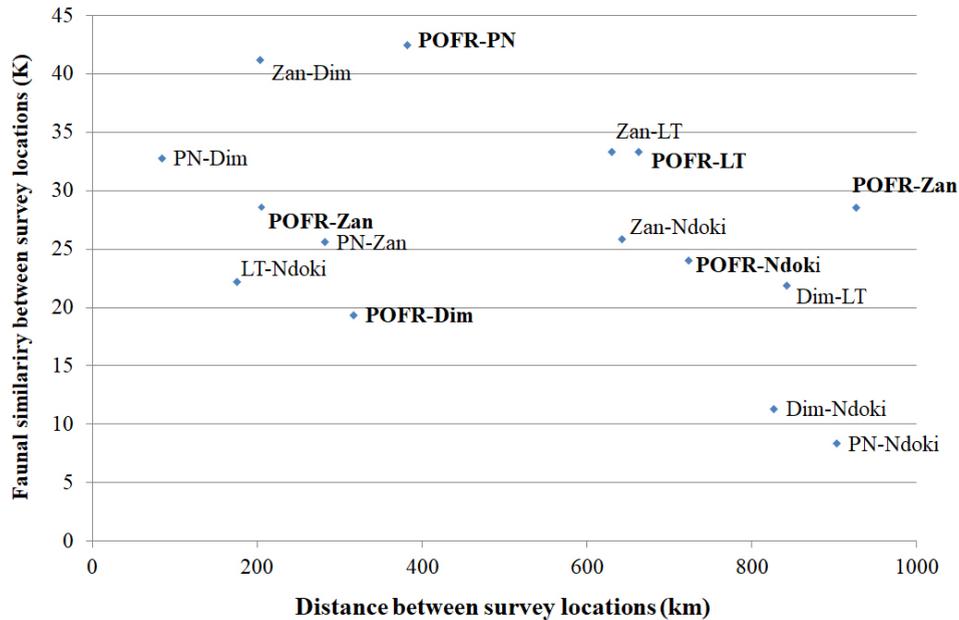


FIGURE 4. Faunal similarity indices (K) of Congo snake survey locations as a function of the distance between them (km). Abbreviations are POFR = Patte d’Oie Forest Reserve, Brazzaville (present study); PN = Pointe-Noire (Jackson and Blackburn 2010); Zan = Zanaga mine site (Zassi-Boulou et al. 2019); Dim = Dimonika (Trape 1985); LT = Lac T  l   (Jackson et al. 2007); Ndoki = Nouabale-Ndoki National Park (Jackson and Blackburn 2007).

within Nouabale-Ndoki National Park in the Sangha Department. Jackson and Blackburn (2010) reported results of a survey carried out at a heavily degraded semi-urban site near the city of Pointe-Noire conducted as part of an environmental impact assessment associated with the construction of a potash factory. Zassi-Boulou et al. (2019) surveyed a relatively undisturbed area of dense primary forest in the Lekoumou Department, as part of an environmental impact assessment in preparation for surface mining of iron ore in the area.

Of these previous surveys of Congo snake faunas, the survey which had the highest faunal similarity index when compared with the POFR snake fauna was by Jackson and Blackburn (2010) survey of a heavily degraded urban site near Pointe-Noire ($K = 42.42$). Brazzaville and Pointe-Noire are separated by a distance of only 382 km, much less than the greatest distance between sites (927 km between Pointe-Noire and Lac T  l  ). If this proximity accounted for their similarity, however, we would expect to that the POFR snake fauna would be even more similar to closer sites such as Dimonika (317 km) and Zanaga (206 km), but this is not the case. Similarity indices for POFR with these two sites are $K = 19.35$ and $K = 28.57$, respectively. Possible reasons for the similarity between these two sites include the fact that both are primarily savannah habitats whereas the other sites are primarily forest. Another possibility, however, is that the species lists from POFR and Pointe Noire each represents the snake fauna of a heavily degraded urban site and that the assemblage of species present represents those species

most able to survive in heavily human-altered habitats and the last species remaining after more specialized and ecologically vulnerable species have disappeared.

Acknowledgments.—We thank the administration of the former Groupe d’Etude et de Recherche en Diversit   Biologique (GERDIB), the administration of the Institut National de Recherche en Sciences Exactes et Naturelles (IRSEN), Professor Joseph Vouidibio, Drs Isabelle Mady Goma Dirat and Armel Ibala Zamba and the staff of the herpetological laboratory for their support in carrying out this work. We thank our colleagues at Whitman College and IRSEN: Heidi Dobson, Sarah Hurlburt, Kirsten Nicolaysen, and Gilbert Nsongola for advice in academic fields outside our own areas of expertise. Although there is no IACUC regulation in Congo in which to adhere, all collecting was carried out in accordance with the guidelines of the American Society of Ichthyologists and Herpetologists (Beaupre et al. 2004) and the Institutional Animal Care and Use Committee of Whitman College. This research was supported in part by Whitman College and by U.S. National Science Foundation grant # 1145437 to KJ.

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Herpetological Conservation and Biology



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APPENDIX 1. Catalogue numbers for voucher specimens collected as a part of this study in the Patte d’Oie Forest Reserve, Brazzaville, Republic of Congo. The abbreviation IRSEN = Institut de Recherche en Sciences Exactes et Naturelles.

Colubridae: *Crotaphopeltis hotamboeia* (IRSEN 00173), *Grayia smithii* (IRSEN 00237), *Philothamnus dorsalis* (IRSEN 00025, IRSEN 00099, IRSEN 00303, IRSEN 00421, IRSEN 00431, IRSEN 00432, IRSEN 00433, IRSEN 00434, IRSEN 00435, IRSEN 00436, IRSEN 00437, IRSEN 00440, IRSEN 00441, IRSEN 00442, IRSEN 00443, IRSEN 00444, IRSEN 00447, IRSEN 00448), Elapidae: *Naja annulata* (IRSEN 00195), *Naja melanoleuca* (IRSEN 00037), Lamprophiidae: *Boaedon perisilvestris* (IRSEN 00005, IRSEN 00030, IRSEN 00079, IRSEN 00081, IRSEN 00082, IRSEN 00083, IRSEN 00132, IRSEN 00133, IRSEN 00181, IRSEN 00284, IRSEN 00285, IRSEN 00286, IRSEN 00302, IRSEN 00308, IRSEN 00449, IRSEN 00450, IRSEN 00451, IRSEN 00452, IRSEN 00453, IRSEN 00454, IRSEN 00456), *Chamaelycus fasciatus* (IRSEN 00455), *Lycophidion laterale* (IRSEN 00084, IRSEN 00085, IRSEN 00130, IRSEN 00192, IRSEN 00198), *Polemon notatus* (IRSEN 00086, IRSEN 00087), *Prosymna ambigua* (IRSEN 00424), *Psammophis phillipsii* (IRSEN 00011, IRSEN 00022, IRSEN 00027, IRSEN 00057, IRSEN 00077, IRSEN 00178, IRSEN 00305, IRSEN 00419, IRSEN 00420), Pythonidae: *Python sebae* (IRSEN 00438, IRSEN 00439), Typhlopidae: *Afrotrophlops congestus* (IRSEN 00245, IRSEN 00299), *Indotyphlops braminus* (IRSEN 00265, IRSEN 00266), *Letheobia caeca* (IRSEN 00298), Viperidae: *Causus maculatus* (IRSEN 00021, IRSEN 00023, IRSEN 00097, IRSEN 00163, IRSEN 00212, IRSEN 00213, IRSEN 00214, IRSEN 00215, IRSEN 00216, IRSEN 00217, IRSEN 00218, IRSEN 00219, IRSEN 00220, IRSEN 00221, IRSEN 00222, IRSEN 00223, IRSEN 00224, IRSEN 00225, IRSEN 00226, IRSEN 00227, IRSEN 00228, IRSEN 00229, IRSEN 00230, IRSEN 00241, IRSEN 00278, IRSEN 00287).