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AMPHIBIANS AND REPTILES OF THE LAC TÉLÉ COMMUNITY RESERVE, LIKOUALA REGION, REPUBLIC OF CONGO (BRAZZAVILLE)

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***Abstract.*—We report here the results of the first herpetofaunal survey of the flooded forest of the Likouala Region of the Republic of Congo (Brazzaville). Collecting was carried out during the rainy seasons of 2005 and 2006, at two sites, one within the Lac Télé Community Reserve, and another just outside its borders. We compare the herpetofaunal assemblages encountered at the two sites, document microhabitat use by species, discuss their relative abundance, and compare our results to those of other herpetological surveys of forested areas of central Africa. We documented 17 amphibian and 26 reptile species. We report a significant range extension for *Hemidactylus pseudomuriceus*; as well as the first report from the Congo of the frog, *Hymenochirus curtipes*.**

***Resumé*.—Cet article rapporte les résultats de la première étude herpétologique menée dans la forêt inondée de la région de la Likouala en République du Congo (Brazzaville). Nous avons collectionnés des spécimens en 2005 et 2006, durant la saison des pluies, en deux endroits : l'un à l'intérieur de la Réserve Communautaire du Lac Télé, l'autre tout juste hors de ses limites. Nous discutons les résultats de notre échantillonnage en comparant les communautés d'espèces trouvées dans les deux sites étudiés, leur micro-habitat et leur densité relative. Nous comparons ces résultats à ceux d'autres études herpétologiques en régions forestières d'Afrique centrale. Nous présentons une liste commentée de 17 espèces de batraciens et de 26 espèces de reptiles. Nous y incluons une observation sur la remarquable extension de la zone de répartition, jusque là connue, du gecko *Hemidactylus pseudomuriceus*, et aussi la première observation du Congo de la grenouille, *Hymenochirus curtipes*.**

Key Words.—Africa; amphibians; biodiversity; Congo; flooded forest; reptiles

INTRODUCTION

The amphibians and reptiles of central Africa represent one of the world's most poorly studied herpetofaunas. Lawson and Klemens (2001) presented an extensive review of herpetological field studies in and around central Africa, ranging from Cameroon to Angola to Tanzania, from the colonial period to 2001. They suggested that the great differences in numbers of species known from different countries represent only differences in sampling effort, not in actual species diversity. As examples, they compared well-studied, species-rich Cameroon with poorly-studied Central African Republic from which a relatively small number of species are known. Not a single reference is made to the Republic of Congo.

A thorough search of the existing literature did turn up a handful of herpetofaunal surveys of the Congo. Each was carried out in the Kouilou River basin and in the Mayombe forest, in the extreme south of the country, a forested area continuous with Gabon (Laurent 1961; Trape 1985; Largen 1991; Largen and Dowsett 1991; Rasmussen 1991). The only exception is Guibé (1946) who reported a one-page list of 13 amphibian and five reptile species collected in the Sangha region, the northwestern corner of the country. In contrast to the *terra firma* forest of the Sangha Region, the Likouala Region, covering the eastern half of northern Congo is largely flooded forest habitat. Both of these areas are part of the forest of the Congo River drainage basin. We know of no previous herpetofaunal survey of the Likouala flooded forest (also referred to as "swamp forest").

The 104,088 km^2 northern Congo forest is imminently threatened by logging while its flora and fauna are still virtually unstudied. Poulsen and Clarke (2002) reported that only 35% of the entire forested area was not already granted to a logging company. Approximately 62,500 km^2 of the Congo forest constitutes swamp forest. The Lac Téle Community Reserve (LTCR), operated by the New York based Wildlife Conservation Society, protects 4,400 km^2 of forest (Poulsen and Clarke 2002). The only glimmer of hope is that the swamp forest biome may be partially protected because of the lack of highly valuable timber trees and the difficulty and expense of logging in swamps.

Our study documented reptile and amphibian species in the flooded forest. Given the absence of previous studies of the region, and the very difficult logistics of working in this area, our objective was simply to document the presence of species and to record anything we learned about their natural history. Our hope was to provide a preliminary species list as a starting point for conservation efforts. If the herpetofauna of the swamp forest is to be

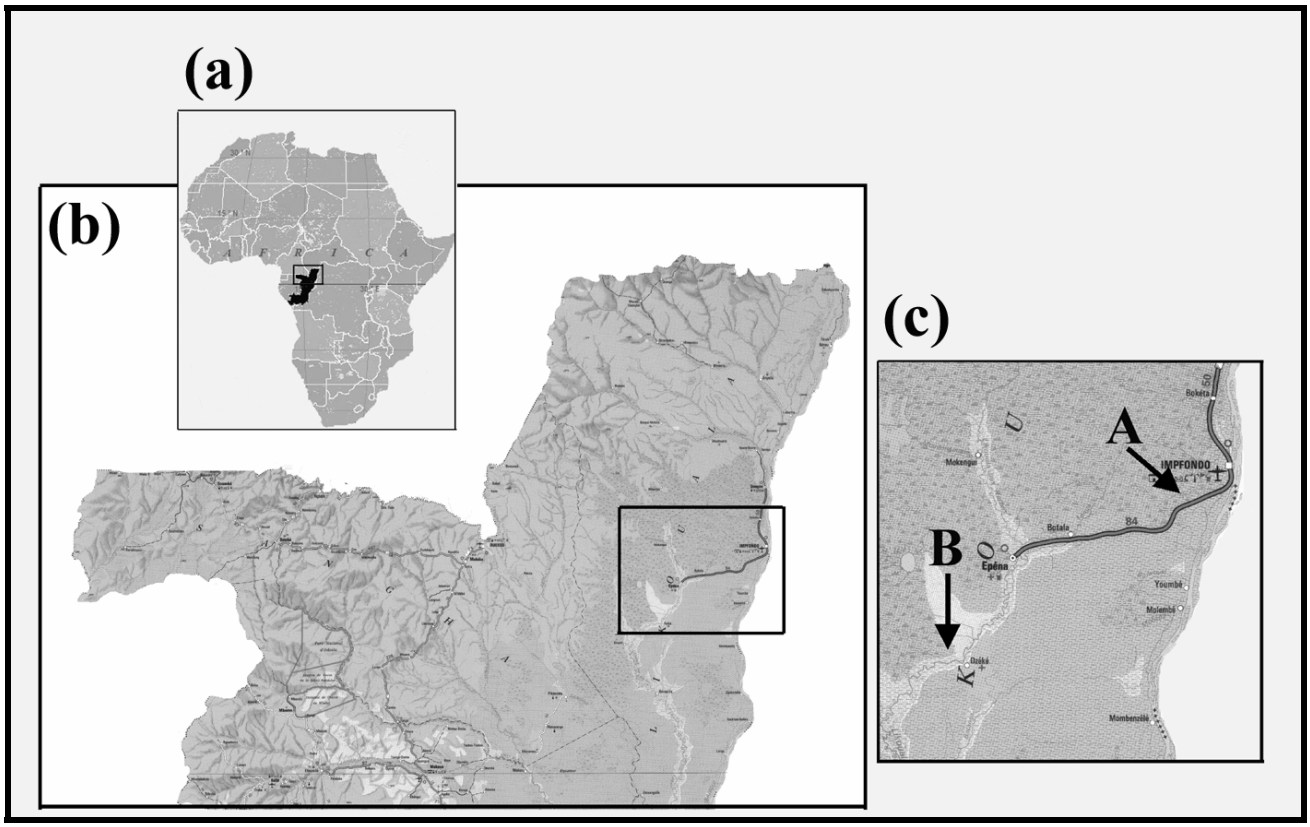

FIGURE 1. Map of the area of study indicating (a) position of the Republic of Congo in Africa (black polygon), (b) the forested northern part of the Congo, and (c) a close-up of the area of study, indicating (A) the 2005 study site near the village of Ganganya Brousse, and (B) the 2006 site near the village of Impongui. Adapted from a map by the Centre de Recherche Géographique et de Production Cartographique, CERGEC Avenue de l'OUA BP 125, Brazzaville.

protected, the first step must be to determine what is present.

MATERIALS AND METHODS

We collected amphibians and reptiles at two sites in the Likouala forest. Crocodiles, turtles, Rock Pythons (*Python sebae*), and varanid and chameleonid lizards were not collected because these taxa have official protection (Dowsett 1991). Although we did not collect these species, we documented their presence if we observed them. Otherwise, we sampled all amphibian, lizard, and snake species. All specimens were preserved as vouchers.

Study sites.—Our project was carried out at two sites, during the rainy season, in two consecutive years (Fig. 1). In October-November, 2005, KJ camped for five weeks, near the village of Ganganya Brousse, on a patch of dry land surrounded by swamp forest (N 001º 30.848', E 017º 56.272'). It was not possible to obtain a permit to work within the LTCR, so a site was chosen in similar habitat just outside the borders of the reserve. The nearest village was Ganganya Brousse. KJ collected in the waters of the flooded forest surrounding the camp and in forest puddles. Locals collected many specimens, mainly from nearby villages. The second site was in *terra firma* forest near the village of Impongui (N 001º 04.610', E 017º 17.981), deep within the LTCR. We sampled this site in November 2006 for four weeks. Habitat was primarily *terra firma* forest, open-river, including flooded savannah, separated from the land by a border of flooded forest with very deep water (Fig. 2. a, b).

Collecting methods.—We used several methods to sample amphibians and reptiles in order to target different taxa. We set gill nets in the water, in the hope of catching aquatic snakes. We set 450 m of net at the Ganganya site, where the water was waist to chest deep, allowing the nets to be checked daily on foot. At Impongui we set 125 m of net. At this site the water was deep enough to require the use of a pirogue (dugout canoe) to check the nets. We constructed pitfall traps and drift fences in *terra firma* forest for the sampling of forest leaf-litter taxa. At the Ganganya site we had no plastic buckets to line the holes, and not a single specimen was captured. At Impongui, we built a wire mesh drift fence 100 m in length, with plastic buckets sunk into the ground at 10 m intervals along its length. We drilled holes in the bottoms of the buckets for drainage during rain, and then covered the holes with wire

mesh secured by duct tape in order to prevent small animals from escaping through the holes. We checked the nets and pitfall traps daily. We actively searched by day in the forest along the edge of the water, and in the village, including turning over of logs and other potential refugia such as piles of bricks. We captured lizards, amphibians and non-venomous snakes by hand, and used a field hook and 12" hemostat to handle venomous snakes. At night we used headlamps to search, primarily for amphibians, in the vegetation near the edge of the water. Villagers collected many specimens, mainly from the village, and contributed these to our project.

Processing of specimens.—We photographed at least one representative of each species. We euthanized amphibians by applying a drop of benzocaine gel to the head, and reptiles by intracardiac injection of a 5% solution of procaine (Altig 1980). We fixed a sample of liver or muscle tissue (approximately $1cm^3$) in 90% ethanol for several representatives of each species for use in molecular studies,. We labeled individuals with paper field number tags corresponding to locality and collection information recorded in the expedition's catalog. We measured snout-vent lengths (SVL) and tail lengths, and sexed snakes by cloacal probing. We then fixed all specimens in 10% formalin solution and left them to harden on a plastic tray for 12hrs. We wrapped specimens in formalin-saturated cheesecloth before storing them in plastic bags. At the completion of the fieldwork, we deposited most vouchers in the herpetology collection of the National Museum of Natural History, Smithsonian Institution. We left some specimens with GERDIB (Groupe d'Etude en Diversité Biologique) in Brazzaville to lay the foundations of a national herpetological collection in the Congo.

TABLE 1. Amphibians and reptiles collected at the Lac Télé Community Reserve, Likouala Region, Republic of Congo (Brazzaville) and the generalized microhabitat located at the capture sites.

Species	Ganganya	Impongui	Village	Forest	Water
Amphibia: Anura					
Amnirana albolabris	X			X	
Aubria masako	X			X	
Aubria subsigillata	X			X	
Bufo camerunensis	X	X			
Bufo maculatus	X	X			
Bufo regularis	X	X	X	X	
Cryptothylax greshoffi		X	X	X	
Hoplobatrachus occipitalis	X	X			X
Hymenochirus curtipes	X				X
Hyperolius sp.		X			X
Phrynobatrachus auritus	X			X	
Leptopelis brevirostris	X			X	
Phrynobatrachus hylaois		X		X	X
Phrynobatrachus sp.		X	X		X
Ptychadena perreti	X	X	X	X	
Schoutedenella sylvatica		X		X	
Silurana epitropicalis	X			X	X
Xenopus fraseri		X		X	
Reptilia: Squamata: Sauria					
Agama agama	X		X		
Hemidactylus fasciatus		X	X		
Hemidactylus mabouia	X	X	X	X	
Hemidactylus pseudomuriceus	X	X	X	X	
Lygosoma fernandi		X	X	X	
Trachylepis affinis		X		X	
Trachylepis maculilabris	X	X	X	X	
Reptilia: Squamata: Serpentes					
Bitis arietans		X			X
Bitis gabonica	X			X	
Bitis nasicornis		X		X	
Boulengerina annulata	X				X
Calabaria reinhardtii		X	X		
Crotaphopeltis hotamboeia		X	X	X	
Dasypeltis scabra	X	X	X		
Grayia ornata	X	X			X
Grayia smithii		X			X
Hapsidophrys smaragdina	X	X	X	X	
Lamprophis f. fulginosus	X	X	X		
Mehelya poensis		X	X		
Naja melanoleuca	X	X	X	X	X
Natriciteres fulginoides	X			X	
Natriciteres olivacea		X			X
Philothamnus heterolepidotus		X		X	
Psammophis phillipsi	X	X	X	X	
Python sebae	X	X			X
Typhlops l. lineolatus		X	X		

RESULTS

We present below a commented list of taxa documented in the course of our study. The terms "rare" and "abundant" are used here to indicate rarity or abundance in our collection, which may not necessarily reflect actual population sizes. We summarize collection data, including locality and micro-habitat, in Table 1. Numbers of individuals collected at the two sites are presented in Fig. 4.

AMPHIBIA: ANURA

Arthroleptidae.—We collected a single specimen of *Schoutedenella sylvatica* (Laurent 1954) during the day, near the edge of the river.

Bufonidae (=Amietophryne).—We collected three species of toads of the genus *Bufo*, with all three represented at both sites. The most abundant at both sites

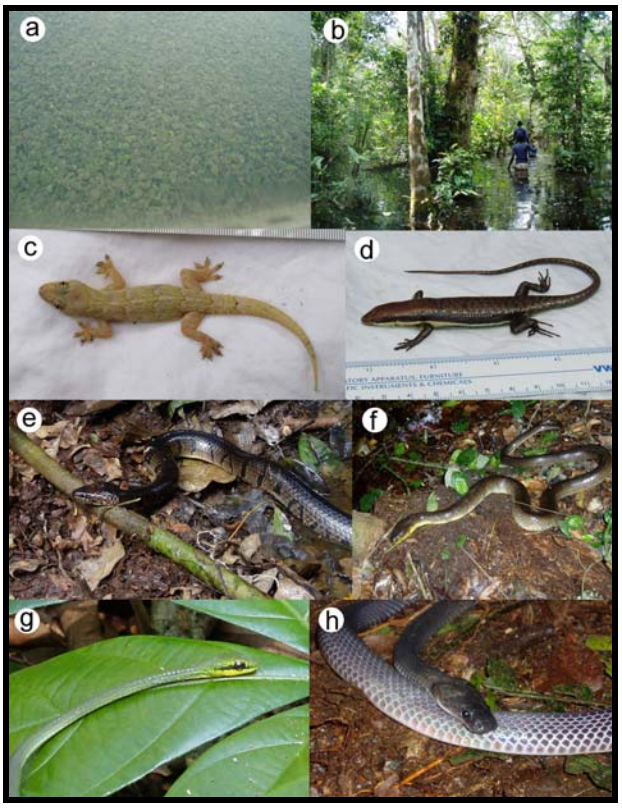

FIGURE 2. Habitat and specimen illustrations: (a) The Likouala forest seen from a plane; (b) Typical flooded forest habitat near the 2005 site; (c) *Hemidactylus pseudomuriceus*; (d) *Trachylepis affinis*; (e) *Grayia ornata*; (f) *Grayia smithii*; (g) *Hapsidophrys smaragdina*; (h) *Mehelya poensis*.

FIGURE 3. Selected amphibians: (a) *Hymenochirus curtipes*; (b) *Silurana epitropicalis*; (c) *Aubria masako*; (d) *Xenopus fraseri*; (e) *Cryptothylax greshoffii*; (f) *Phrynobatrachus hylaois*; (g) *Bufo regularis*; (h) *Bufo camerunensis*.

was *B. regularis* (Reuss 1833) (Fig. 3g). We collected at Ganganya Brousse all specimens by day only, and at the edge of the forest and the edge of a marsh. At Impongui, we captured one specimen in a pitfall trap near the shallow, marshy shoreline of the river, while the remaining 30 individuals were collected in the village, both by day and night. This apparent difference in habitat type may reflect only the fact that our camp at Ganganya Brousse was much further from the village than our campsite at Impongui. *Bufo camerunensis* (Parker 1936) (Fig. 3h) and *B. maculatus* (Hallowell 1854) were much rarer, with only three specimens of each from the two sites combined. *Bufo camerunensis* was found only in the forest: One collected by hand in the forest at the Ganganya site, and two in forest pitfall traps in the forest near Impongui. Of the three specimens of *B. maculatus*, we collected one by hand in the forest near Ganganya, a second Ganganya specimen was brought in by a Lingala-speaking villager, with no collection data, and we collected the single Impongui specimen in the village with the *B. regularis*. We had difficulty distinguishing species using the key from Perret and Amiet (1971), but we confirmed identifications referencing specimens in the collection of the USNM.

Hyperoliidae.—We collected three specimens of *Cryptothylax greshoffi* (Schilthuis 1889) (Fig. 3e) around the Impongui site: One individual on a tree in the village in the middle of the day, one at the shallow, marshy edge of the river at night, and one on the forest floor, 5 m from the water in deep forest near our camp. No specimens of this species were encountered at the Ganganya Brousse site. The specimens from Impongui represent the second report of this species in the Congo, the first being three specimens from near Bomassa in the Sangha Region (Blackburn and Jackson 2006).

A single specimen of a frog that we tentatively assign to the genus *Hyperolius* (Rapp 1842) was obtained near Impongui. The specimen was found "in the river" by one of our guides and presented to us a day later, in poor condition. We were unable to identify it with reference to Schiøtz (1999). As of 2 March 2007, the specimen is awaiting final identification.

Two specimens of the large treefrog, *Leptopelis brevirostris* (Werner 1898), were obtained near our Ganganya Brousse site: One on the road at the edge of the forest at night, after a rainstorm, the other in a shallow puddle deep in the forest in the afternoon. This is the second report of this species from the Congo, the first was

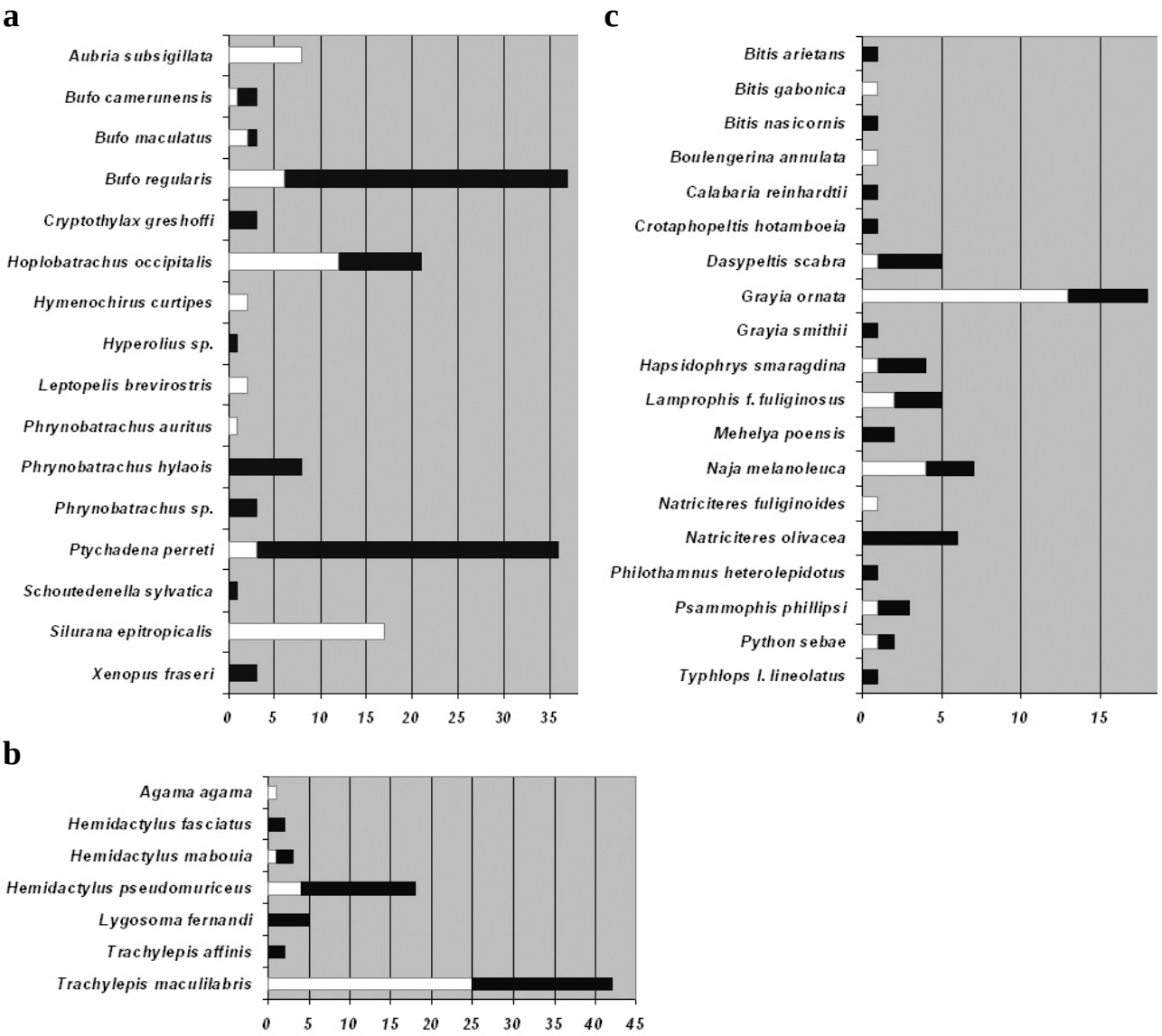

FIGURE 4. Numbers of individuals of each species collected from the Lac Télé Community Reserve, Likouala Region, Republic of Congo (Brazzaville). Number of specimens from the Ganganya site is indicated in white; number of specimens from the Impongui site in black. (a) Numbers of individuals of amphibians collected. (b) Numbers of individuals of lizards collected. (c) Numbers of individuals of snakes collected.

from the Sangha Region (Jackson and Blackburn in press). We did not find individuals of this species at Impongui.

Ranidae.—We collected a single specimen of *Amnirana albolabris* (Hallowell 1856) at the Ganganya site. Although *A. albolabris* is said to be a "farmbush" species inhabiting open or degraded habitats close to swamps and slow-moving streams (Perret 1977), our specimen was captured in a small pond in the forest one morning following a rainstorm.

We found frogs of the genus *Aubria* exclusively at the Ganganya site, and always in shallow pools deep in the forest. Our results here are the second report for the Congo of *Aubria masako* (Ohler and Kazadi 1990) (Fig. 3c), recently reported by Jackson and Blackburn (in press) from the Sangha forest. Although *A. masako* was the less common of the two species, *A. masako* were regularly collected together with *Aubria subsigillata* (Duméril 1856) from the same small pools (or deep puddles).

The African Bullfrog, *Hoplobatrachus occipitalis* (Günther 1858), is a very common species widely distributed throughout Africa. We collected specimens of this large species from both sites, which were always captured by hand at night at the shallow edges of marshy water. They were easily located by their call and by eye shine from a headlamp beam.

Ptychadena perreti (Guibé and Lamotte 1958) was the most abundant amphibian species we collected at Impongui. The species was common in the village at all

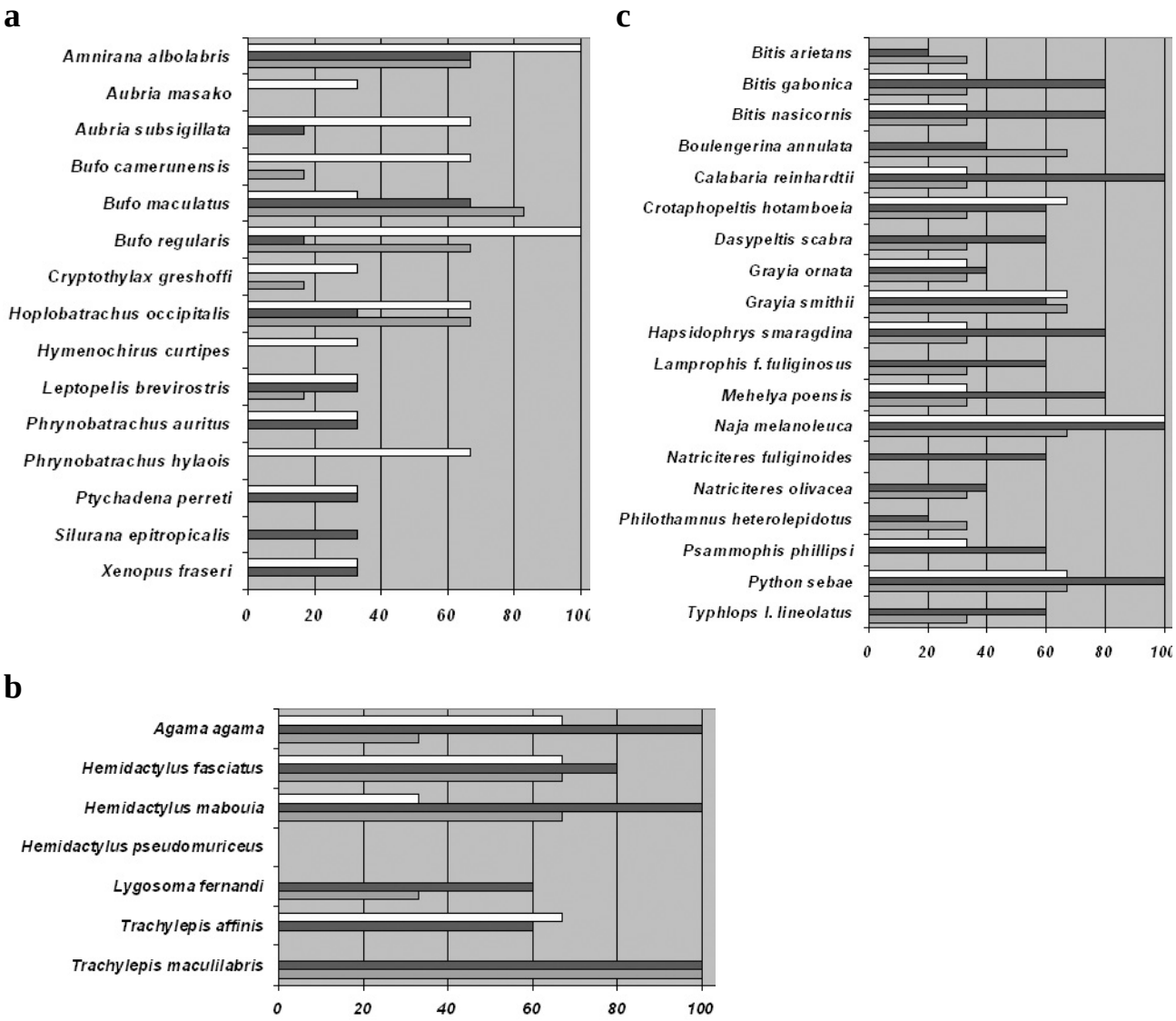

FIGURE 5. Presence of the species documented in this study in the three forest blocks described above, based on comparisons with other studies: (a) amphibians; (b) lizards; and (c) snakes. From top to bottom, the three bars represent (1) in white, the Upper Guinea forest (West Africa); (2) in black, the Lower Guinea forest (further east); and (3) in grey, Congolia (Congo River drainage basin). The numbers on the x-axis indicate in what percentage of studies each species was documented. We compared ours results to the following studies: for the Upper Guinea forest De la Riva (1994), Rödel and Mahsberg (2000), Branch and Rödel (2003), Rödel and Branch (2002), Rödel and Agyei (2003), Rödel and Ernst (2003), Emms et al. (2005), Leaché et al. (2006); for the Lower Guinea forest, Laurent (1961), Joger (1990), Largen (1991), Largen and Dowsett-Lemaire (1991), Rasmussen (1991), Lawson (1993), Herrmann et al. (2005), Pauwels, et al. (2006); for Congolia only Schmidt and Noble (1919-1923), Guibé (1946), and Jackson and Blackburn (in press). Guibé (1946) is merely an uncommented list of 18 taxa collected in the Sangha, while the former is an exhaustive checklist for the Democratic Republic of Congo.

times of day, as well as on forest trails. Specimens were easily captured at night in shallow marshy water with *H. occipitalis*.

Phrynobatrachidae.—We collected a single individual of *Phrynobatrachus auritus* (Boulenger 1900) at the Ganganya Brousse site in a shallow puddle in the forest during the afternoon. Near Impongui, we collected eight specimens of *Phrynobatrachus hylaois* (Perret 1959) (Fig. 3f). We captured Four specimens in pitfall traps positioned close to the shallow, marshy edge of the river. The remaining four we captured were by hand during the day in water ranging from very shallow to approx. 1.5 m depth along the river's edge. We collected three more specimens of what we think represents a third species of *Phrynobatrachus* at Impongui; two at the water's edge and one in a brick pile in the village.

Pipidae.—*Silurana epitropicalis* (Fischberg, Colombelli and Picard 1982) (Fig. 3b) was abundant at the Ganganya Brousse site and entirely absent at Impongui. We collected all specimens at night in the shallow edge of a pond at the

edge of the forest. The *Xenopus "fraseri"* (Boulenger 1905) "group" is now thought to represent six distinct species. However, distinguishing these species by morphology alone is virtually impossible, as the characters that separate them are largely biochemical (Tinsley and Kobel 1996), and thus beyond the scope of this study. Species identification can also be made by advertisement calls, but we did not hear calls and we lacked the technology to record them. We collected tissue samples, however, making species identification of our specimens by biochemical characters a possibility for future researchers. We found no *X. fraseri* (Fig. 3d) at the Ganganya Brousse site, and only three specimens at Impongui. Two of these we collected in pitfall traps in the forest, while a third we captured on the ground under a tarpaulin shelter during a rainstorm. *Silurana epitropicalis* was distinguished from the *X. fraseri* group by reference to Parker (1936).

We encountered two individuals of *Hymenochirus curtipes* (Noble 1924) (Fig. 3a) in the flooded forest at the Ganganya Brousse site. The two were a pair in amplexus resting on the top string of a gill net in water approximately 1 m deep. These are the first specimens of this species known from the Congo, as reported by Jackson and Beier (2006).

REPTILIA: SQUAMATA

Agamidae.—We captured a single individual of *Agama agama* (Linnaeus 1758), a common, diurnal species with a large distribution in Sub-Saharan Africa (Spawls et al. 2002), in the village of Ganganya Brousse.

Gekkonidae.—We collected three species of geckos of the pan-tropical genus *Hemidactylus*. *Hemidactylus fasciatus* (Gray 1842), the largest most distinctive in appearance of *Hemidactylus* known from Cameroon, and is known both from forests and from the walls of houses (Bauer et al. 2006). It was represented in our collection by two individuals collected together from a brick pile in the village of Impongui. Geckos were much more abundant at the Impongui site than at Ganganya Brousse. Surprisingly, the most abundant species at both sites was the ostensibly rare *H. pseudomuriceus* (Fig. 2c), described by Henle and Böhme (2003) and previously known only from two localities; the locality of the type specimen in Cote d'Ivoire, and the second in Cameroon. We identified specimens based on the morphological details of the original description. All specimens collected by Henle and Böhme (2003) were from primary forest, on elevated terrain, but close to swamps. The four specimens that we collected from the area around Ganganya Brousse and the 14 specimens from Impongui were found during the day as well as at night. We found them on indoor and outdoor walls in the village, on forest trails, in pitfall traps placed 5 m from the shallow marshy edge of the river, and on the crumbling foundations of abandoned buildings far from the village. We collected one specimen of *H. mabouia* (Moreau de Jonn 1818) by day in the village of Ganganya Brousse, and two specimens near Impongui, one under a board in the village at midday, and the other on a forest trail at dusk. This species is widespread and abundant throughout Africa, and tolerates a wide range of habitats (Spawls et al. 2002).

Scincidae.—*Lygosoma fernandi* (Boulenger 1887) has a large distribution in Africa. Very distinctive because of its large size and red and black coloration, it is a forest species and is seen rarely (Spawls et al. 2002). We encountered this species only at the Impongui site, where we collected five individuals; four adults and one juvenile, none of which were in the forest. We collected two specimens in pitfall traps near the shallow, marshy edge of the river, one in the village during the afternoon, one in an open grassy area near the village, and one in a manioc field in the forest. These microhabitats probably represent simply locations where specimens were easier to find than when they were hidden in the forest leaf litter.

Trachylepis maculilabris (Gray 1845) was the most abundant lizard at both sites. We collected it by day in the village and in the forest, by hand as well as in pitfall traps. In contrast, *Trachylepis affinis* (Gray 1838) (Fig. 2d) was represented by only two specimens in our collection, both of which we captured in forest pitfall traps near the Impongui site. We identified this species using Hoogmoed (1974).

Typhlopidae.—A single specimen of *Typhlops l. lineolatus* (Jan 1864), described by Trape and Roux-Estève (1995) as abundant in the Congo and found in both forest and savannah habitats, was donated by villagers at Impongui. The small specimen was almost chopped into five pieces with a machete. Scolecophidians are among the several taxa that are referred to as "*double-têtes*" (double heads) in the region of our study because their blunt tail makes it difficult to tell one end from the other. Other "*doubles-têtes*" include the snake, *Calabraia reinhardtii*, as well as legless lizards of the genus *Feylinia*. Inexplicably, all *double-têtes* are greatly feared. Scolecophidians are sometimes referred to as the "five minute snake" because it is thought that if it bites a person, the victim will die in five minutes.

Boidae.—At Impongui, villagers brought us a specimen of the fossorial boid, *Calabaria reinhardtii* (Schlegel 1848). Like the *Typhlops* described above, this species, with its blunt head and tail, is classed by locals among the feared "*double têtes*". The specimen presented to us had had both head and tail chopped off with a machete and both were discarded.

We captured a single juvenile specimen of *Python sebae* (Gmelin 1789) in our nets at each of the two sites.

Because of their protected status, these specimens were documented but not collected.

Colubridae.—We collected a single individual of *Crotaphopeltis hotamboeia* (Laurenti 1768) under a bush in the village of Impongui during the daytime. Trape and Roux-Estève (1995) report that this species is very common in savannahs, while Chippaux (2006) describes it as very common around human habitations and cultivated areas, which is consistent with our observation. Chippaux adds that it is crepuscular and nocturnal, often emerging after rain, and a relatively harmless mimic of the viper *Causus sp.*, which we did not encounter.

Of the three species of the genus *Dasypeltis* known from the Congo, we collected five *D. scabra* (Linnaeus 1758). This species is known from savannahs, in contrast to *D. fasciatus*, which is found in forests (Trape and Roux-Estève 1995). We collected four specimens in damp locations around the Impongui site (edge of water, in wet vegetation, and during a rainstorm), usually in the evening. The single specimen from Ganganya was a roadkill in poor condition. Chippaux (2006) reports that this species is semi-arboreal, but none of our specimens were found climbing.

We captured two species of the genus *Grayia*, a large, harmless, banded aquatic snake that mimics the Water Cobra, *Boulengerina annulata*. In the flooded forest around our camp at Ganganya, we captured so many *G. ornata* (Bocage 1866) (Fig. 2e) in our nets that we eventually started releasing them, and finally took the nets down. With the exception of one *B. annulata*, large specimens of *G. ornata* were the only snakes we ever collected in the nets. At Impongui we had fewer nets and more difficult access to them, with the predictable result that we captured fewer snakes. While *G. ornata* was still the most common species in the nets, we also caught one specimen of *G.smithii* (Leach 1818) (Fig. 2f) and one *P. sebae*.

We collected four specimens of the green treesnake, *Hapsidophrys smaragdina* (Schlehgel 1837) (Fig. 2g): one tiny juvenile near the Ganganya site, and one juvenile and two large specimens at Impongui. Chippaux (2006) describes this species as strictly arboreal and diurnal. However, we found one juvenile in forest leaf litter during the day, and one swimming in the river in the early evening. Of the two larger specimens, we captured one on the ground in a large cleared area at night in the rain, while the other was found inside a house in the village of Impongui. These capture sites may simply represent conditions in which the specimens were easy to see and catch rather than suggesting that they are not primarily arboreal. Following fixation in formalin and storage in ethanol, the two juvenile specimens turned black, while the two large specimens turned pale blue. We have no explanation to account for this difference.

Lamprophis f. fuliginosus (Boie 1827), like other species of this genus, is most commonly encountered around human habitations, though Trape and Roux-Estève (1995) report that it is common in savannahs. All five specimens in our collection were obtained by taking apart brick piles in villages. We collected two almost black individuals in the village of Ganganya, and three paler grey specimens from Impongui. Of the Impongui specimens, two were found in a brick pile together with *Mehelya poensis*, while we found a third individual in another brick pile that also contained a single *Naja melanoleuca*.

We captured two specimens of *Mehelya poensis* (Smith 1847) (Fig. 2h) from a brick pile in the village of Impongui, which they were sharing with two of the *L. f. fuliginosus* described above. Trape and Roux-Estève (1995) describe this species as mainly limited to forests.

Two species of the genus *Natriciteres*, *N. fuliginoides* (Gunther 1858) and *N. olivacea* (Peters 1854), are known from the Congo (Trape and Roux-Estève 1995), and both are represented in our collection. Although both are described as semi-aquatic and diurnal in their habits, *N. olivacea* is most often encountered in flooded forest, while *N. fuliginoides*, though also a forest species, is less tied to water (Chippaux 2006). At Ganganya we collected a single individual of the latter species in forest floor leaf litter. It was a tiny specimen (SVL = 14 cm) with the tail broken off (the tails of *Natriciteres* break off very easily). We did not collect a single specimen of *N. olivacea* at the Ganganya site, in spite of being surrounded by apparently ideal flooded forest habitat. At our Impongui site, by contrast, we captured five specimens of this species by hand, and except for one specimen found in damp vegetation, all were swimming near the water's edge,.

The genus *Philothamnus* is a large and speciose group of diurnal, arboreal snakes. We collected one specimen of *P. heterolepidotus* (Gunther 1863) on the ground in the evening at the village of Impongui. *Psammophis phillipsi* (Hallowell 1844) was the only species of purportedly arboreal, green treesnake in our collection that we actually encountered in trees. We obtained three large specimens. At Ganganya a single specimen was acquired from a villager with unconvincing collection data. At the Impongui site, we found both specimens in palm trees. This diurnal species is known from secondary forest and mixed forest/savannah habitats (Chippaux 2006).

Elapidae.—In contrast to the great abundance of Water Cobra mimics (genus *Grayia*), we found actual Water Cobras, *Boulengerina annulata* (Buchholz and Peters 1876), to be relatively rare. We collected only one individual in the course of our study. This was a very large individual (SVL = 142 cm) captured in our gill nets at the Ganganya site. These were the same nets that were yielding such large numbers of *Grayia ornata*.

The Forest Cobra, *Naja melanoleuca* (Hallowell 1857), was the second most abundant species of snake that we

found (after *Grayia ornata*). We collected seven individuals, representing three distinct size classes. At Ganganya we found three juveniles (SVL < 50 cm) in the leaf litter near the forest edge, one of them a roadkilled specimen at the edge of the forest. A large specimen (SVL > 2 m) was captured in a forest trap by hunters. At Impongui, we found two large specimens in the water, one in our gill nets, the other on a baited #8 fishhook probably intended for capturing Dwarf Crocodiles (*Osteolaemus tetraspis*). A specimen of intermediate size (SVL = 83 cm) was collected from a brick pile in Impongui village.

Viperidae.—In the course of our study, we obtained the three species of the genus *Bitis* known from the Congo. We found a single juvenile specimen of *B. arietans* (Merrem 1820) swimming at the edge of the river near Impongui. Trape and Roux-Esteve (1995) described this as strictly a savannah species, as did Chippaux (2006), who added that it is also encountered in plantations. Also near Impongui, villagers captured a large *B. nasicornis* (Shaw 1802) in the forest using a long fishing harpoon. In contrast to the *B. arietans* collected, the micro-habitat of this specimen is consistent with Trape and Roux-Estève (1995) and Chippaux's (2006) description of it as the most forest-restricted of the three species. A specimen of *B. gabonica* (Dumeril et al. 1854), a primarily forest species that also sometimes ventures into cultivated areas and even villages (Chippaux 2006), was captured in the forest near Ganganya.

REPTILIA: CROCODILIA

Crocodylidae.—A woman in the village of Djeke (N 01° 03.544', E 017° 18.546'), across the river from Impongui, had in her possession two hatchling West African Dwarf Crocodiles, *Osteolaemus tetraspis*, which she tried (unsuccessfully) to sell to us. Because this species is hunted for its meat, it is unclear to us what she intended to do with these two tiny individuals.

DISCUSSION

Biogeographic comparisons.—White (2001) divides the forested areas of West and Central Africa into three "centers of endemism": Upper Guinea is the forest that stretches from Ghana west to Liberia. This forest is disjunct from Lower Guinea extending from Benin eastward, continuous with Congolia, the forest of the Congo River drainage basin proper. We judge our site, and the forest of the northern part of the Congo in general, as belonging to the western edge of the latter, because all the rivers within that area drain into the Congo River. We attempt here to compare the herpetofaunal assemblage that we encountered in the Likouala Region with other herpetofaunal studies of these three areas of African forest. This comparison was difficult for several reasons. The three areas have not been studied to an equal extent. While a significant literature exists for the Upper and Lower Guinea forests, we found very little literature dealing with the Congolia area. Moreover, these studies, even when available, were difficult to compare. Some included only amphibians and some only reptiles. Some were checklists for a particular protected area or for an entire country, some were exhaustive lists of everything known or presumed present, while others were preliminary surveys like ours. Surveys were carried out at different times of the year (rainy season versus dry season), for different lengths of time, and differing in all the variables discussed above in the context of the comparison of the two sites in the present study. This effort to quantify comparisons was not ideal because of the differences between the different studies and different numbers of studies available for the three regions, as explained above.

We found our collection to most closely resemble the list reported from the Congolia forest by Schmidt and Noble (1919-1923). The only taxa in our collection that were not included in their list were species described since their study. The percentages for Congolia are lower than they would otherwise be (Fig. 5) because of the inclusion of Guibé's (1946) very short list. The next most similar fauna was, as anticipated, that of the Lower Guinea forest. Almost all our species were represented among the Lower Guinea literature, with the exceptions of three rare amphibian species (*Aubria masako, Cryptothylax greshoffi, and Hymenochirus curtipes*). *Bufo camerunensis* also failed to appear in any of these studies, but is included in Perret and Amiet (1971). The Upper Guinea forest lacked so many species from our list, that we did not record them all here (but see Fig. 5).

The most similar previous study available for comparison is Jackson and Blackburn's (in press) study of Ndoki-Nouabale National Park in the Sangha Region of the Congo. This survey was similar to our work because it is geographically close (approximately 150 km NW of the site covered in this study), they spent a similar length of time in the field and used similar sampling methods. However, they were in *terra firma* forest instead of swamp forest, and this study was carried out in the dry season rather than the rainy season. The results, though, were similar. Ten of the 18 species of amphibian reported here were included among the 21 documented in the Ndoki study. Two of the three lizard species on the Ndoki list were included among the seven reported here, and two species of snake, of the six documented in the Ndoki survey were among the 19 snake species reported here for the Lac Télé Community Reserve.

Implications for conservation.—Of all the species documented here, only two are listed by CITES (CITES Listed Species Database [http://www.cites.org] downloaded 5 March, 2007): *Osteolaemus tetraspis* (CITES I), and *Python sebae* (CITES II). The IUCN Red

List gives "endangered" status to *O. tetraspis*, and "data deficient" to *Hymenochirus curtipes*. All the other species are either listed as "least concern" or not in the database (IUCN Red List of Threatened Species [http://www.iucnredlist.org] downloaded 5 March, 2007).

Based on our study and other sources, including Amphibiaweb, Global Amphibian Assessment (Global Amphibian Assessment Website [http://www.globalamphibians.org] downloaded 5 March, 2007), Guibé and Lamotte (1958), and Schiotz (1999), we judge some species to be particularly threatened by habitat destruction. Of the amphibians, *Aubria masako*, *Cryptothylax greshoffi*, *Hymenochirus curtipes*, and *Leptopelis brevirostris* are rare in collections, which may reasonably be interpreted as indicating rarity in the wild. Our data suggest that *Silurana epitropicalis* may be locally abundant, and it is dependent on small water holes in rainforest. We consider it to be threatened by habitat loss, as are the forest floor leaf-litter frogs of the genus *Phrynobatrachus*. *Xenopus fraseri* is considered to be very abundant but threatened because of hunting by locals for consumption and because of habitat loss. The above habitat and conservation status information come from Amphibiaweb, Global Amphibian Assessment Website, Guibé and Lamotte (1958), and Schiøtz (1999).

A possible cause for concern is the presence of *Bufo regularis*, which we found in large numbers at both sites. A species common to savannah and to heavily degraded habitats, *B. regularis* enters forests only as an invasive species, generally using logging roads (Amphibiaweb [http://www.amphibiaweb.org] downloaded 5 March, 2007). If true, it is surprising to find this species in the areas we studied. The Ganganya site, admittedly, was not far from a major road, but how these toads could have made their way to Impongui is puzzling.

Among the lizards that we documented, *H. pseudomuriceus*, which we found to be abundant, is considered very rare. However, this probably reflects only the fact that the species was described very recently (Henle and Böhme 2003), and that many previously collected specimens of this species were erroneously assigned to *H. muriceus*. *Hemidactylus fasciatus* and *Lygosoma fernandi* are both forest-dependent species, but *L. fernandi* at least has a very broad distribution in sub-Saharan Africa.

Among the snakes, *Bitis nasicornis*, *Philothamnus heterolepidotus*, and *Natriciteres olivacea*, as well as the more common *Boulengerina annulata*, *Grayia ornata*, and *G. smithii* require specifically wet/flooded forest habitat. Other species, which are restricted to forest in general, are *Natriciteres fuliginoides*, *Mehelya poensis*, and *Calabaria reinhardtii*. *Naja melanoleuca*, also a forest species, has a very wide distribution and is generally abundant based on our comparisons with surveys from other locations. *Bitis gabonica*, though a forest species, is more adaptable to habitat change than *B. nasicornis*. Other species encountered in the course of our survey are either species associated with human habitations, or are savannah species. Habitat use information is taken from Chippaux (2006) and from Trape and Roux-Estève (1995).

The present study represents only a very preliminary survey of a large and previously unstudied biome, and as such, its limitations must be recognized. The herpetofaunal assemblage of the Lac Télé Community Reserve and of the flooded forest of northern Congo, in general, warrants further study.

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LITERATURE CITED

Altig, R. 1980. A convenient killing agent for amphibians. Herpetological Review 11:35.

Bauer, A.M., Lebreton, M., Chirio, L., Ineich, I., and M.T. Kouette. 2006. A new species of *Hemidactylus* (Squamata: Gekkonidae) from Cameroon. African Journal of Herpetology 55:83-93.

Blackburn, D.C. and K. Jackson. 2006. *Cryptothylax greshoffii*: Geographic distribution. Herpetological Review 37:358.

Branch, W.R. and M.-O. Rödel. 2003. Herpetological survey of the Haute Dodo and Cavally forests, western Ivory Coast, Part II: Trapping results and reptiles. Salamandra 39:21-38.

Chippaux, J.-P. 2006. Les serpents d'Afrique occidentale et centrale. IRD Editions, Paris, France.

De la Riva, I. 1994. Anfibios anuros del Parque Nacional de Monte Alén, Río Muni, Guinea Ecuatorial. Revista Espanola de Herpetologia 8:123-139.

Dowsett, R.J. 1991. Les lois gérant la conservation de la nature au Congo : critiques et recommandations. Tauraco Research Report 4:323-334.

Emms, C., M.D. Jambang, O.B. Bah, B. Mankali, M.-O. Rödel, and L. Barnett. 2005. The amphibian fauna of The Gambia, West Africa. Herpetological Bulletin 94:6-16.

Guibé, J. 1946. Reptiles et batraciens de la Sangha (Congo Français) récoltés par M.A. Baudon. Bulletin du Muséum 28:52.

Guibé, J., and M. Lamotte. 1958. Les *Ptychadena* (Batraciens, Ranidés) du Cameroun. Bulletin de l'Institut Français de l'Afrique Noir 20:1448-1463.

Henle, K., and W. Böhme. 2003. A new species of *Hemidactylus* (Squamata: Gekkonidae) from West Africa, and comments on species hitherto confused with *H. muriceus*. African Journal of Herpetology 52:23-38.

Herrmann, H.-W., W. Böhme, P.A. Herrmann, M. Plath, A. Schmitz, and M. Solbach. 2005. African biodiversity hotspots: the amphibians of Mt. Nlonako, Cameroon. Salamandra 41:61-81.

Hoogmoed, M.S. 1974. Ghanese lizards of the genus *Mabuya* (Scincidae, Sauria, Reptilia). Zoologische Verhandelingen No. 138.

Jackson, K., and M. Beier. 2006. *Hymenochirus curtipes*: Geographic distribution. Herpetological Review 37:488.

Jackson, K., and D.C. Blackburn. In press. The amphibians and reptiles of Nouabale-Ndoki National Park, Republic of Congo (Brazzaville). Salamandra.

Joger, U. 1990. The herpetofauna of the Central African Republic, with description of a new species of *Rhinotyphlops* (Serpentes: Typhlopidae). Pp. 85-102 *In* Vertebrates of the Tropics. Peters, G. and R. Hutterer (Eds.). Museum Alexander Koenig, Berlin, Germany.

Laurent, R.F. 1961. Etude d'une collection herpétologique du Mayombe. Revue de Zoologie et de Botanique Africaines 63:262-276.

Largen, M.J. 1991. Lizards, turtles and tortoises (Reptilia: Sauria & Cryptodira) from the Kouilou River basin, République du Congo. Tauraco Research Report 4:169-173.

Largen, M.J., and F. Dowsett-Lemaire. 1991. Amphibians (Anura) from the Kouilou River Basin, République du Congo. Tauraco Research Report 4:145-168.

Lawson, D.P. 1993. The reptiles and amphibians of the Korup National Park project, Cameroon. Herpetological Natural History 1:27-90.

Lawson, D.P. and M.W. Klemens. 2001. Herpetofauna of the African Rain Forest: Overview and Recommendations for Conservation. Pp 291-310 *In* African Rain Forest Ecology and Conservation: An Interdisciplinary Perspective. Weber, W., L.J. White, A. Vedder, and L. Naughton-Treves (Eds.). Yale University Press, New Haven, Connecticut, USA.

Leaché, A.D., M.-O. Rödel, C.W. Linkem, R.E. Diaz, A. Hillers, and M.K. Fujita. 2006. Biodiversity in a forest island: Reptiles and amphibians of the West African Togo Hills. Amphibian and Reptile Conservation 4:22-45.

Parker, H. 1936. The amphibians of the Mamfe division, Cameroon: Zoogeography and systematics. Proceedings of the Zoological Society of London 1936:135-163.

Pauwels, O.S.G., M. Burger, W.R. Branch, E. Tobi, J.-A. Yoga, and E.N. Mikolo. 2006. Reptiles of the Gamba Complex of protected areas, southwestern Gabon. Pp. 309-318 *In* Alonso, A., M.E. Lee, P. Campbell, O.S.G. Pauwels, and F. Dallmeier (Eds.). Bulletin of the Biological Society of Washington, Number 12.

Perret, J.-L. 1977. Les *Hylarana* (Amphibiens, Ranidés) du Cameroun. Revue Suisse de Zoologie 84:841-868.

Perret, J.-L. and J.-L. Amiet. 1971. Remarques sur les *Bufo* (Amphibiens Anoures) du Cameroun. Annales de la Faculté des Sciences du Cameroun 5:47-55.

Poulsen, J. and C. Clarke. 2002. Feasibility Study Report of the Lac Télé Community Reserve. Wildlife Conservation Society. 140 p.

Rasmussen, J.B. 1991. Snakes (Reptilia: Serpentes) from the Kouilou River basin, including a tentative key to the snakes of République du Congo. Tauraco Research Report 4:175-188.

Rödel, M.-O., and D. Mahsberg. 2000. Vorläufige Liste der Schlangen des Tai-Nationalparks/ Elfenbeinküste und angrenzender Gebiete. Salamandra 36: 25-38.

Rödel, M.-O., and W.R. Branch. 2002. Herpetological survey of the Haute Dodo and Cavally forests, western Ivory Coast, Part I: Amphibians. Salamandra 38:245-268.

Rödel, M.-O., and A.C. Agyei. 2003. Amphibians of the Togo-Volta Highlands, eastern Ghana. Salamandra 39:207-234.

Rödel, M.-O., and R. Ernst. 2003. The amphibians of Marahoué and Mont Péko National Parks, Ivory Coast. Herpetozoa 16:23-39.

Schiøtz, A. 1999. Treefrogs of Africa. Frankfurt/M. Edition Chimaira, Frankfurt am Main, Germany.

Schmidt, K. and G.K. Noble. 1919-1923. Contributions to the Herpetology of the Belgian Congo. Contributions to Herpetology: Facsimile Reprint. Society for the Study of Amphibians and Reptiles, Ithaca, New York, USA.

Spawls, S., K. Howell, R. Drewes, and J. Ashe. 2002. A Field Guide to the Reptiles of East Africa: Kenya, Tanzania, Uganda, Rwanda, and Burundi. A & C Black, London, UK.

Tinsley, R. and H.R. Kobel. (Eds.). 1996. The Biology of *Xenopus*. Oxford University Press, New York, New York, USA.

Trape, J. F. 1985. Les serpents de la région de Dimonika (Mayombe, République Populaire du Congo). Revue de Zoologie Africaine 99:135-140.

Trape, J. F., and R. Roux-Estève. 1995. Les serpents du Congo: Liste commentée et clé de détermination. Journal of African Zoology 109:31-50.

White, L.J.T. 2001. The African rain forest: climate and vegetation. Pp 3-29 *In* Weber, W., L.J.T. White, A. Vedder & L. Naughton-Treves (Eds.). African Rain Forest Ecology and Conservation: An Interdisciplinary Perspective. Yale University Press, New Haven, Connecticut, U.S.A.

KATE JACKSON (above) is an Assistant Professor of Biology at Whitman College. She is shown here removing a snake (*Grayia ornata*) from a net in the swamp forest of northern Congo. She received her Hon. B.Sc. and M.Sc. in Zoology from the University of Toronto and her Ph.D. in Biology from Harvard University. Her research interests range from evolutionary morphology of venomous snakes to herpetological biodiversity of Central Africa.

ANGE ZASSI-BOULOU (above) is a graduate student at the Université Marien-Ngouabi in Brazzaville, Republic of Congo. He is shown here formalin-fixing toads at our camp near Impongui in 2006. Although he had studied field biology in northern Congo before, the 2006 expedition was Ange's introduction to amphibians and reptiles. His ambition is to one day teach Herpetology at the Université Marien-Ngouabi.

LISE MAVOUNGOU (left) is an undergraduate project student at the Université Marien-Ngouabi. She is shown here taking measurements for the construction of a pitfall trapline in the forest. The expedition to Impongui in 2006 was Lise's first experience conducting fieldwork.

SERGE PANGOU is the director of GERDIB, the Biological Diversity Research and Study Group, in Brazzaville, and the supervisor of Ange and Lise's theses.