REPTILES AND NATIONAL PARKS IN GABON, WESTERN CENTRAL AFRICA

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(with two text-figures)

ABSTRACT.– **A synthesis of the current state-of-knowledge of herpetofaunal diversity in the recently-created Gabonese national park system is provided. A provisional reptile list is currently available for only four of the 13 parks: Crystal Mountains, Loango, Lopé and Moukalaba-Doudou. Representation of endemic, near-endemic and legally-protected Gabonese reptiles in the parks is analyzed. Only one of the seven (near-)endemic species is recorded from a national park. Among non-park sites, Mount Iboundji and the Rabi oil field (including Lake Divangui) were shown to be of high herpetological interest, enough to constitute adequate biodiversity sanctuaries. Enforcement and revision of protection laws, especially regarding sea turtles, softshell turtles and crocodiles, is urgently needed.**

KEYWORDS.– **Reptiles, Cheloniidae, Trionychidae, Crocodylidae, biodiversity, conservation, national parks, Iboundji, Rabi, Gabon, Africa.**

In memory of the late Jens B. Rasmussen (University of Copenhagen), a brilliant herpetologist and a dearly missed friend

INTRODUCTION

In 2002, H. E. Omar Bongo Ondimba, President of Gabon, officially declared the establishment of 13 national parks covering 30,000 square km, i.e., 10% of the country's territory (Anonymous, 2002b:3; see Figures 1−2). The main objective of these parks is to preserve the high biodiversity of the pristine ecosystems of Gabon, and, through ecotourism, to contribute to diversification of the national economy, presently based on oil exploitation and logging. A detailed description of the parks with their geographical situation and potential ecotourist attractions has been provided by Anonymous (2002a, b). Six other sites of particular conservation interest which did not receive the status of national park are: Wonga-Wongué Reserve, the Ogooué Wetlands (just south of the latter Reserve), Mount Iboundji (Ogooué-Lolo Province), Rabi-Ndogo (Ogooué-Maritime Province), "Northeast", and Minkol-Makok (inselbergs in Woleu-Ntem Province) (Anonymous, 2002a; 2002b). The Ogooué Wetlands were proposed as a "Biosphere Reserve (UNESCO)", due to their rich aquatic fauna, including crocodiles and chelonians (Anonymous, 2002b:83). No precise geographical delimitations were specified for these six sites except for the Wonga-Wongué Reserve.

Our current state-of-knowledge validates the 13 parks as of high biodiversity value and as potential refuges for most ecological assemblages and species of Gabon, yet detailed inventories are lacking for most biological groups in most parks, including for reptiles, the least-studied

vertebrates in Gabon. A comprehensive list of the reptiles of the country was indeed not available until 2004 (Frétey and Blanc, no date), and moreover that list has to be seriously revised (Pauwels, 2004a). Many old literature species records are doubtful and have to be carefully checked, due notably to the fact that what was formerly called Gabon does not necessarily correspond to today's actual borders of this country. Also in recent literature, some species records were shown to be erroneous (Pauwels and Branch, 2003).

Based on the current state-of-knowledge, Gabonese reptile endemic taxa are the worm-lizards *Cynisca bifrontalis* (Boulenger, 1906) and *C. haughi* (Mocquard, 1904) (Amphisbaenidae), the legless skink *Feylinia boulengeri* Chabanaud, 1917 (Scincidae) and the newly-described blind snake *Letheobia pauwelsi* Wallach, 2005 (Typhlopidae). Near-endemic taxa (known so far to be limited to Gabon and directly bordering countries) include the recently-discovered mud terrapin *Pelusios marani* Bour, 2000 (Pelomedusidae) and forest gecko *Hemidactylus kamdemtohami* Bauer and Pauwels, 2002 (Gekkonidae), and the aquatic snake *Hydraethiops laevis* Boulenger, 1904 (Colubridae). These near-endemic species are known only by either one or two localities outside Gabon, in Cameroon, Equatorial Guinea and/or Congo-Brazzaville.

Figure 1. Map of Africa showing the position of Gabon.

In addition to continuing taxonomic and field research towards the establishment of a more accurate national reptile list, a herpetological conservation priority in Gabon is to evaluate the representation of the herpetofauna in its national parks, especially for (near-)endemic and endangered species. A synthesis of current (May 2005) knowledge, as presented below, will help orient future efforts.

MATERIALS AND METHODS

The following compilation on the reptile fauna of each park is based on a detailed study of all reliable literature available on the reptiles of Gabon, and on intensive field work made by the first author from 2001 to 2005 in all parts of Gabon except the north-east (Minkébé area) and the southeast (Franceville area, Bateke Plateaux). Our field surveys were mainly sponsored by WWF-CARPO (in *Monts de Cristal*, *Massif du Chaillu* and central Gabon) and by the Smithsonian Institution, Shell Foundation and Shell Gabon (in the Gamba Complex of Protected Areas, southwestern Gabon) and were documented through voucher specimens deposited in museum collections in Gabon and abroad (specified in our publications, see literature cited). Species records not strictly made within actual park borders are not considered for the park lists. National Park delimitations agree with those presented by Anonymous (2002a; 2002b).

Abbreviations: N. P.: National Park; SI/MAB: Smithsonian Institution/Monitoring and Assessment of Biodiversity Program.

RESULTS

Akanda National Park (540 sq. km).— In the chapter devoted to Akanda N. P., Anonymous (2002b:17) noted that "the undersea pastures of Corisco bay are important feeding zones for turtles, which come from as far afield as Brazil." Fretey and Girardin (1988) considered local accounts of nesting by *Dermochelys coriacea* (Vandelli, 1761) in the Park near Moka doubtful since the beaches seem very muddy and thus not suitable for the turtles. Pauwels and Vande weghe (2005) and Vande weghe (2005) listed *Osteolaemus t.*

Table 1. List of reptile species for the nine Gabonese national parks for which records are available. Only records from strictly within the park borders are taken into account. Literature and sources for species records is specified in the account for each park.

Taxa/Parks	Akanda	Crystal	Ivindo	Loango	Lopé	Mayumba	Minkebe	Moukalaba	Pongara
Chelonii									
Pelomedusidae									
Pelusios castaneus				X				X	
Pelusios marani								X	
Pelusios niger				X					
Cheloniidae									
Chelonia mydas				X		X			X
Eretmochelys imbricata									X
Lepidochelys olivacea				X		X			
Dermochelyidae									
Dermochelys coriacea				X		X			X
Testudinidae									
Kinixys erosa		X		X	X		X	X	
Trionychidae									
Cycloderma aubryi				X					
Trionyx triunguis				X				X	
Crocodylia									
Crocodylidae									
Crocodylus cataphractus			X	X				X	
Crocodylus niloticus				X				X	
Osteolaemus t. tetraspis	X			X	X		X	X	X
Lacertilia									
Agamidae									
Agama agama		X		X				X	X
Agama cf. *paragama*					X				
Chamaeleonidae									
Chamaeleo dilepis				X					
Rhampholeon s. spectrum		X						X	
Gekkonidae									
Hemidactylus fasciatus		X		X	X			X	
Hemidactylus mabouia	X	X		X	X			X	X
Hemidactylus muriceus				X				X	
Gerrhosauridae									
Gerrhosaurus nigrolineatus				X	X			X	X
Lacertidae									
Poromera fordii					X				
Scincidae									
Feylinia currori					X				

Feylinia grandisquamis				X			X	
Lygosoma fernandi				X				
Panaspis breviceps		X		X			X	
Panaspis reichenowii				X			X	
Panaspis rohdei		X						
Trachylepis affinis	X			X	X		X	X
Trachylepis albilabris		X		X			X	X
Trachylepis maculilabris					X		X	
Trachylepis polytropis				X	X		X	
Varanidae								
Varanus ornatus	X	X		X	X	X	X	
Serpentes								
Atractaspididae								
Aparallactus modestus		X			X			
Atractaspis corpulenta							X	
Boidae								
Calabaria reinhardtii					X		X	
Colubridae								
Boiga blandingii		X		X	X			
Boiga cf. *pulverulenta*					X		X	
Bothrophthalmus brunneus							X	
Crotaphopeltis hotamboeia							X	
Dasypeltis fasciata		X						
Dasypeltis scabra					X			
Dipsadoboa duchesnii				X			X	
Dipsadoboa underwoodi							X	
Dipsadoboa viridis		X					X	
Dipsadoboa weileri							X	
Gonionotophis b. brussauxi							X	
Grayia ornata					X		X	
Hapsidophrys smaragdinus		X		X	X		X	
Hydraethiops melanogaster					X			
Lamprophis olivaceus					X			
Mehelya guirali							X	
Mehelya poensis		X						
Mehelya savorgnani							X	
Mehelya stenophthalmus				X				
Natriciteres fuliginoides				X	X		X	
Philothamnus carinatus		X		X	X		X	
Philothamnus heterodermus					X			
Psammophis cf. *phillipsii*				X	X			
Rhamnophis aethiopissa				X	X		X	
Thelotornis kirtlandii		X						

Thrasops flavigularis				X					
Elapidae									
Boulengerina a. annulata		X			X				
Dendroaspis j. jamesoni					X		X	X	
Naja melanoleuca		X			X		X	X	
Pseudohaje goldii							X		
Pythonidae									
Python sebae	X	X		X	X		X		X
Typhlopidae									
Typhlops angolensis				X					
Typhlops congestus					X				
Viperidae									
Atheris squamiger		X			X		X	X	
Bitis arietans								X	
Bitis gabonica				X	X		X	X	
Bitis nasicornis	X	X							
Causus lichtensteini								X	
Causus maculatus					X				
Total: 75	**6**	**22**	**1**	**37**	**34**	**3**	**9**	**44**	**10**

tetraspis Cope, 1861 (Crocodylidae), *Hemidactylus mabouia* (Moreau de Jonnès, 1818) (Gekkonidae), *Trachylepis affinis* (Gray, 1838) (Scincidae), *Varanus ornatus* (Daudin, 1803) (Varanidae), *Python sebae* (Gmelin, 1789) (Pythonidae) and *Bitis nasicornis* (Shaw and Nodder, 1792) (Viperidae) from the park. No data are available for other reptiles, but, due to the homogeneity of biotopes, the total diversity is most probably low.

Bateke Plateaux National Park (2,050 sq. km).— No herpetological data are available for the Park, which harbors biotopes that are unique in Gabon. The Park could constitute a sanctuary for the uncommon terrapin *Pelusios carinatus* Laurent, 1956, known so far in Gabon from only five localities situated just north of the Park (Maran, 2002:51). Geographically-close records of other savanna-dwelling species, like *Elapsoidea semiannulata moebiusi* Werner, 1897 (Elapidae) in Franceville (Broadley, 1971), seem to indicate the local existence of a typical savanna herpetofauna. We expect that thorough surveys will bring a number of new records for the country, especially among savanna-dwelling species, since the park's savanna is a continuation of the Congolese savanna.

Crystal Mountains National Park (1,200 sq. km).— Field surveys have been conducted by Gossmann et al. (2002) and Pauwels et al. (2002b) in the Park and its immediate vicinity, providing a preliminary list of 48 species. Among them only 22 species were actually recorded strictly within the Park borders (see Table 1), but all 48 species and many others can be expected from the park, since the other records were made in the Park's immediate vicinity in similar biotopes, and the total search effort so far was limited. The herpetofauna is expected to be similar to that of Monte Alen in Equatorial Guinea. All but ten of the 48 species recorded from the Crystal Mountains, thus 79%, were indeed recorded from Monte Alen N. P. (compare with the list provided by Lasso et al., 2002), and all the remaining species of the 65 found in Monte Alen can be expected from Crystal Mountains N. P.

Ivindo National Park (3,000 sq. km).— Steel (1994:4) recorded *Crocodylus cataphractus* Cuvier, 1825 and *C. niloticus* Laurenti, 1768 from the "Réserve d'Ipassa" and mentioned that 65 reptile species were recorded from the same part of the Park (including *Crocodylus cataphractus*, *Osteolaemus tetraspis* and *Varanus niloticus* (Linnaeus, 1766) [probably *V. ornatus*]

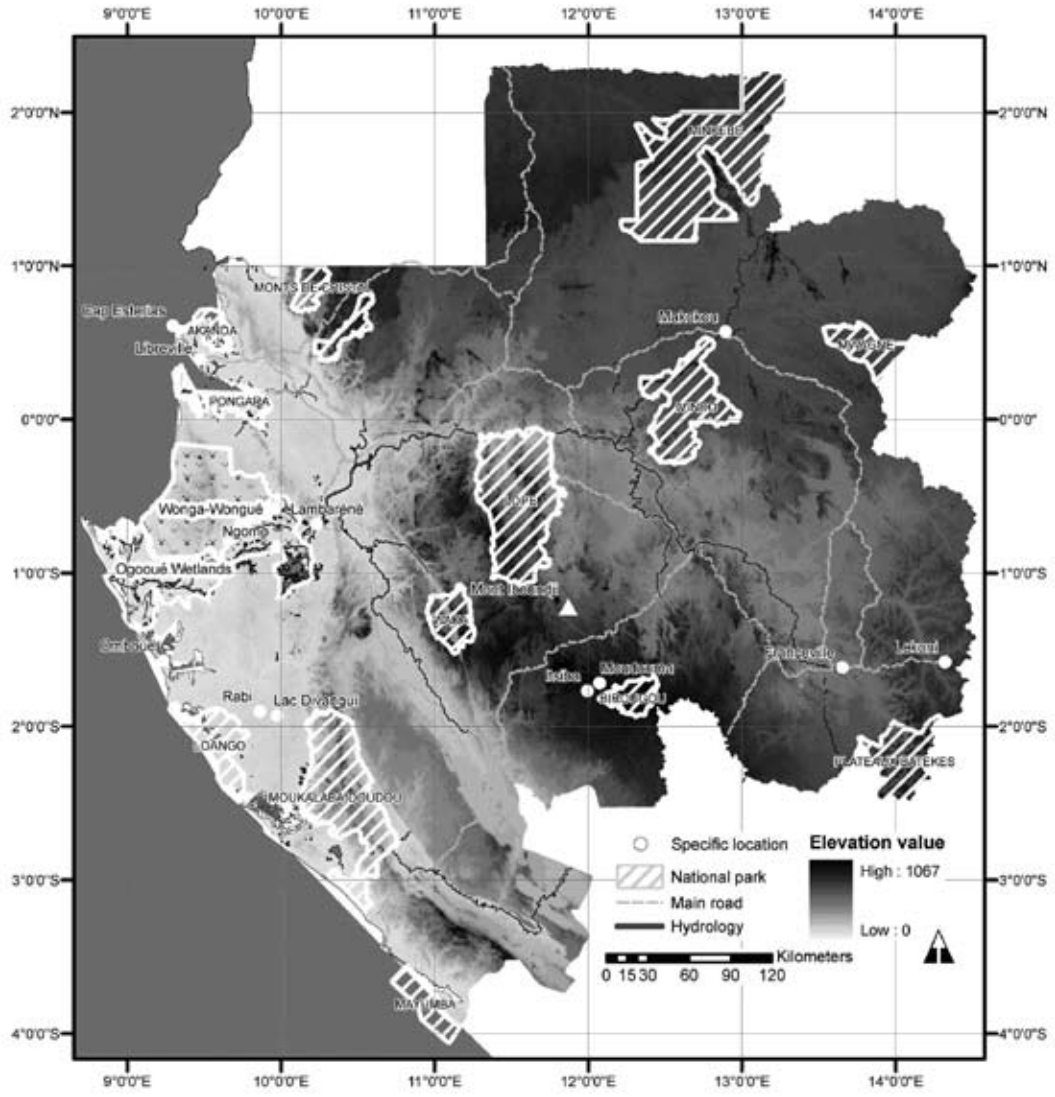

Figure 2. Map of Gabon, showing the relief and hydrography, and the national parks and other sites and localities mentioned in the text.

according to Anonymous, 1994:9). It is likely that Steel (1994) was referring to the unpublished report by Anonymous (no date - b) who listed 65 reptile species from the Ivindo Basin (see also Blanc and Frétey, 2000:289); however this latter anonymous report does not give any precise indication on the localities, nor any reference to preserved museum material. Steel's (1994) record of *Crocodylus niloticus* requires confirmation. A number of the species recorded by Knoepffler (1966, 1974) at and around Makokou must be present in the park, including the regional endemic snakes *Gonionotophis b. brussauxi* (Mocquard, 1889) (Colubridae) and *Paranaja multifasciata* (Werner, 1902) (Elapidae). Knoepffler's records from Loa-Loa (13 species) and his record of *Cycloderma aubryi* (Duméril, 1856) from "en aval des chutes de Mingouli" ("downstream Mingouli waterfalls") might actually have been made within the parks borders. In conclusion, the only reptile record unambiguously made within the Park limits to date is that of *Crocodylus cataphractus* by Steel (1994). Within the park, Mont Kinguié (749 m

asl) is possibly home to high altitude taxa and would deserve dedicated herpetological surveys.

Loango National Park (1,550 sq. km).— On the entire West African coast, Loango N. P. may be the most beautiful, ecologically-intact example of the juxtaposition of lowland forest, savanna, swamp, lagoon and marine ecosystems (Anonymous, 2002b:31; Lee et al., 2005). A two-month herpetological survey of the Park was conducted in 2002, recording 37 species (Pauwels et al., 2004a; see Table 1). Among others, evidence of the nesting of *Chelonia mydas* (Linnaeus, 1758), *Lepidochelys olivacea* (Eschscholtz, 1829) and *Dermochelys coriacea* was found, although Anonymous (2002b) did not mention sea turtles in the brief description and highlights for Loango N. P. The occurrence and seasonal abundance of sea turtles might, however, become a popular attraction for ecotourism in the Park. Pauwels et al. (2004a) provided a list of species that could be expected from the Park, and predicted a total of about 50 species.

Lopé National Park (4,970 sq. km).— This was the first protected area of the country, declared as such in 1946 (Anonymous, 2002b:7). This is also the first Gabonese protected area to have benefitted from a herpetological survey: a list of 38 species was established by Blanc and Frétey (2000). It includes two crocodile and other protected species, and an *Agama* population referred as to *A. paragama* Grandison, 1968 by these authors and as *A.* cf. *paragama* by Pauwels et al. (2002a); the status of this population requires further study. Blanc and Frétey (2000) included records that were actually made just outside the park; moreover, the Park delimitations were partly modified after their work. If one considers today's delimitations (according to Anonymous, 2002a; 2002b), only 34 records were made within the Park (see Table 1). The remaining four species recorded by Blanc and Frétey (2000) might, however, be expected from the Park, as they were recorded from biotopes represented within the park next to the Park borders. Christy and Wilmé (2003) mentioned the "crocodile à museau court" (*Osteolaemus tetraspis tetraspis*), "varan" (*Varanus ornatus*; with picture in loc. cit.:91) and "python" (*Python sebae*) from Offoué River near Ololo Camp. Many additional species should be added to the Park herpetofauna, notably through surveys in the hilly southern part of the park which belongs to the *Massif du Chaillu*.

Mayumba National Park (80 sq. km).— Fretey and Girardin (1988) considered the park the most important nesting site for *Dermochelys coriacea* in Gabon. The Park was, moreover, qualified as the "most important nesting site for leatherback turtles on Earth," and proposed as a World Heritage Site (Anonymous, 2002b:11, 41, 43). Billes (2003) provided data on the locally-nesting population of *Dermochelys*, and stressed important conservation problems, including local human predation on *Dermochelys*, *Chelonia mydas* and *Lepidochelys olivacea*. Data on other reptile species are totally lacking for the park, but its small land surface and high homogeneity in biotopes suggests that herpetofaunal diversity must be low, i.e., probably even lower than those of Akanda and Pongara Parks.

Minkebe National Park (7,570 sq. km).— Nearly no herpetological data are available for the park, which is, nonetheless, by far the largest in Gabon. Anonymous (no date - a:9) mentioned that Sally Lahm recorded eight reptile species from the Minkébé area. Steel (1992) mentioned the 11 reptile species listed by Lahm (1991) from Minkebe forest: *Kinixys erosa* (Schweigger, 1912), *Osteolaemus t. tetraspis*, *Varanus niloticus* (probably *V. ornatus*), *Thrasops* sp., *Dendroaspis jamesoni* (Traill, 1843), *Naja melanoleuca* Hallowell, 1857, *Pseudohaje goldii* (Boulenger, 1895), *Python sebae*, *Typhlops* sp., *Atheris chloroechis* (sic; probably *A. squamiger* [Hallowell, 1854]) and *Bitis gabonica* (Duméril, Bibron and Duméril, 1854). These records of *Thrasops* sp. and *Typhlops* sp. require vouchers and confirmation, since they might concern other genera as well (respectively *Rhamnophis* Günther, 1862 and *Leptotyphlops* Fitzinger, 1843 or *Ramphotyphlops* Fitzinger, 1843 – this latter genus having recently been added in Gabon by Pauwels et al., 2004b). With its large surface of pristine forest, its high peaks (particularly those above 650 m asl) and inselbergs, Minkebe N. P. undoubtedly harbors a rich herpetofauna, among them probably a number of species yet-unrecorded from Gabon, but known from southern Cameroon, or even new taxa.

Mount Birougou National Park (690 sq. km).— No herpetological collection has been done within the park, but survey work has taken place in its immediate vicinity in the Itsiba and Moudouma areas by Pauwels et al. (2002a, c). The altitude of Mount Birougou is 975 m (Anonymous, 2002b:21). With one of the highest peaks of Gabon, a largely-intact forest, and its remote situation in the heart of the *Massif du Chaillu*, this park is a very promising research field site for herpetologists.

Moukalaba-Doudou National Park (4,500 sq. km).— *Crocodylus cataphractus* was mentioned from Lake Kivoro by Dijkstra (1993:259). Obame Ondo (2000:8) reported that about 16 reptile species were listed from the *Monts Doudou*, without specifying which, but more information on this inventory was available in the report of Bagafou et al. (2000) where some taxa are identified down to the specific level. The detailed results of this first survey were eventually provided by Burger et al. (2004), who produced the first documented reptile list for the park. A more recent second survey brought in a number of new records, giving a current total list of 42 species (Pauwels et al., 2005; see Table 1). Minko Ekomo (no date:11) listed *Crocodylus niloticus* from the *Monts Doudou* (see also Burger et al., 2004:175). On 30 April 2005, we (OSGP) observed two subadult *C. niloticus* basking on partly-immersed logs in the Nyanga River within the Park, and examined a large skull in Igotchi (Nyanga Province, Basse-Banio Dept.), which is said to have been caught in the Nyanga in front of the village. A specimen of *Bitis arietans* (Merrem, 1820) was observed in 1987 in the park near Mourindi (PC, unpubl. data). Although this viper species was not listed for Gabon by Frétey and Blanc (no date), it might be found in the savanna areas of Gabon (another specimen caught in the savanna along Road 16 between Udéac and Lékoni, just north of Bateke Plateaux N. P., was examined by J. Maran, pers. comm.). Field surveys in the highest peaks of the park will certainly add new records, and possibly new taxa.

Mwagne National Park (1,160 sq. km).— No herpetological data are available for the park. Due to its relatively small size and mainly low relief, we do not expect it to house an especially rich nor unique herpetofauna.

Pongara National Park (870 sq. km).— *Dermochelys coriacea* was mentioned from the park by Fretey and Girardin (1988) and Vande weghe (2005). Pauwels and Vande weghe (2005) and Vande weghe (2005) also listed *Chelonia mydas* and *Eretmochelys imbricata* (Linnaeus, 1766) (Cheloniidae), *Osteolaemus t. tetraspis* (Crocodylidae), *Hemidactylus mabouia* (Gekkonidae), *Gerrhosaurus nigrolineatus* Hallowell, 1857 (Gerrhosauridae) and *Python sebae* (Pythonidae). On 12 Sept. 2004, we (OSGP and J. P. Vande weghe) caught, identified and released specimens of *Agama agama* (Linnaeus, 1758) (Agamidae), *Gerrhosaurus nigrolineatus* (Gerrhosauridae), *Mabuya affinis* and *M. albolabris* (Scincidae), all locally abundant. Vande weghe (2005) mentioned that *Crocodylus niloticus* was probably once present, but is surely absent today from the park. The whole herpetofauna is probably not very diverse, and identical to that of Akanda N. P.

Waka National Park (1,070 sq. km).— No herpetological information is available for the park, which is probably home to the species recorded from low and middle altitude by Pauwels et al. (2002a) in other parts of the *Massif du Chaillu*. The highest summits might harbour *Hemidactylus kamdemtohami* or *Letheobia pauwelsi*, both known from Mount Iboundji situated at less than 70 km.

DISCUSSION

General representation of reptiles in Gabon's national parks.— Seventy-five reptile species are so far known to be represented in the national parks of Gabon (Table 1). The total number of reptiles currently recorded from the whole country is still a matter of discussion, since a number of historical and non-documented records have to be re-evaluated. Lötters et al. (2000) and Pauwels (2004) estimated a total number of 95 and 140 reptile species for Gabon (respectively). The longest list currently available is that of Frétey and Blanc (no date) who mentioned 160 species. These latter authors did not include *Hemidactylus kamdemtohami*, *Letheobia pauwelsi*, *Ramphotyphlops braminus*, *Hydraethiops laevis* nor *Bitis arietans*, added to the Gabonese herpeto-

fauna after submission of their manuscript (see Pauwels, 2004a; Pauwels et al., 2002a, 2004b; Wallach, 2005; and the present work). A number of species should also probably be withdrawn from their list (see Pauwels, 2004a).

If one considers the highest figure of 160 species and 76 genera by Frétey and Blanc without corrections, 47% of the species, 66% of the genera, and all families (22) except Amphisbaenidae and Leptotyphlopidae are currently recorded from the parks. In view of the early stage of herpetological inventory of the parks of Gabon, a representation of nearly half of all species, and all families but two (moreover discreet fossorial taxa that can be easily overlooked) is satisfying. Future surveys will undoubtedly increase the present figures, and we strongly encourage a focused effort on research in national parks, both to increase their scientific and ecotouristic value and to ensure that listed species are effectively protected. We also encourage inventories in geographically-exceptional sites outside parks, like mountain tops, inselbergs, caves, waterfalls, isolated lakes, etc., to increase their state of biological knowledge and possible justification as biodiversity sanctuaries.

Representation of endemics and near-endemics.— Endemics: *Cynisca bifrontalis* was only known by its holotype from Omboué (Ogooué-Maritime Province, Etimboué Dept.) until our recent discovery of five additional specimens in Rabi/Toucan oilfields, ca. 90 km south-east of the type locality (Branch et al., 2003). The presence of *C. bifrontalis* in Loango N. P. is very probable, and it might also be expected from Moukalaba-Doudou N. P., since Rabi is situated between both parks. The other Gabonese endemic amphisbaenian *Cynisca haughi* is still known only by its holotype from "Gabon, à environ 50 km au sud-ouest de Lambaréné" (Gabon, about 50 km SW of Lambaréné), along the Ogooué wetlands which was proposed as a Biosphere Reserve (Anonymous, 2002b). Additional specimens of *C. haughi* should be collected in order to confirm it is not conspecific with *C. bifrontalis*, since the female holotype is in poor condition and does not allow the examination of some important diagnostic characters (Branch et al., 2003)– in the case of synonymy the name *C. haughi* would have priority.

Feylinia boulengeri, regarded by some authors (e.g., Frétey and Blanc, no date) as belonging to the monotypic Feyliniine genus *Chabanaudia* de Witte and Laurent, 1943, is known from only two localities and two specimens: "N'Gomo, Ogooué, Gabon" (MNHN 1917.120; holotype) and "Riv. Bilogone, Gabon" (MNHN 1969.105) (Brygoo and Roux-Estève, 1983). N'Gomo (= Ngomo; see Figure 2) is situated in Moyen-Ogooué Province, Dept. de l'Ogooué et des Lacs. Bilogone (= Mbilagone) River flows from Wonga-Wongué Reserve to Pongara N. P.

Mount Iboundji's blind snake *Letheobia pauwelsi* is still known by a single specimen that was caught on the flank of Mount Iboundji (Pauwels et al., 2002a). Due to its obvious fossorial habits, the species could be more common than it seems; it could be searched for in the southern, hilly, part of Lopé N. P., and in Mount Birougou N. P.

Near-endemics: Since its discovery, *Pelusios marani* has been found in a dozen localities in Gabon, and in a single locality, "environs de Brazzaville" ("surroundings of Brazzaville"), in Congo-Brazzaville (Bour et al., 2001; Maran, 2002; Pauwels et al., 2002d). Its recent record from Moukalaba-Doudou N. P. (Pauwels et al., 2005) represented its first mention from a protected area. In view of the high predation pressure by humans, *P. marani* will soon be under threat, and this Moukalaba-Doudou record is thus very important.

Kamdem Toham's gecko *Hemidactylus kamdemtohami* was first collected on the flank of Mount Iboundji in the *Massif du Chaillu*, and observed in Monte Alen N. P. in Equatorial Guinea (Pauwels et al., 2002a). It was then later reported from southern Cameroon (Pauwels, 2004b) and will probably be found on more mountains in the region.

Pauwels et al. (2002a) rediscovered in Moudouma (660 m asl) the aquatic snake *Hydraethiops laevis*, which was formerly only known from its two syntypes from Efulen (670 m asl) in Cameroon. Since Moudouma village is situated less than 10 km from Mount Birougou N. P., this rare snake most likely occurs in the park.

Representation of locally-protected species.— Decree nº32/PR/MEF of 11 January 1966 gave integral protection of the three crocodiles spe-

cies, with a derogation every year for a hunting period. Commercial hunting hence, took place, especially in the area of Lambaréné, in Ogooué River and adjacent lakes. This decree was renewed every year until 1975, when intensive hunting had so depleted the natural stocks that commercial hunting became non-viable. According to the present Gabonese laws, no reptile is integrally protected, but the following six species are partly protected following decree 189/PR/MEFCR of 4 March 1987 relative to the protection of fauna: *Dermochelys coriacea* (Dermochelyidae), *Crocodylus cataphractus congicus* and *C. niloticus*, *Osteolaemus t. tetraspis* (Crocodylidae), *Varanus niloticus* (Varanidae) and *Python sebae* (Pythonidae).

Dermochelys, although suffering from human predation, is recorded from three coastal parks, among them Mayumba N. P. which is one of the most important nesting sites worldwide for the species (Billes, 2003).

The subspecies *Crocodylus cataphractus congicus* Fuchs, Mertens and Wermuth, 1974, is not universally accepted. Besides its records from three parks, *C. cataphractus* still has a wide distribution in Gabon (Waitkuwait, 1985), but is heavily hunted everywhere (Gramentz, 1999; Pauwels et al., 2003). Conservation measures are urgent.

Dupuy et al. (1998:27) indicated that *Crocodylus niloticus* was probably extinct in Gabon because of intensive hunting. Fortunately this is wrong, since *C. niloticus* is presently known with certainty from Loango and Moukalaba-Doudou parks, but it is not sure whether it occurs in other parks. The Nile crocodile was probably once more common (Anonymous, 2004), and probably present in at least Pongara N. P. (Vande weghe, 2005) and Akanda N. P. Blaney et al. (1997:67) mentioned it from "rivière Mougouambi, tronçon Mayonami-Moulondo" (Nyanga Province, Basse-Banio Dept.). Today it seems limited to the coastal areas of the Gamba Complex of Protected Areas and to the Nyanga River (Bourobou Bourobou, 1999:12; Camara Gakou, 1992:23; Dijkstra, 1993; Pauwels et al., 2005). In 1996, Gramentz (1999) however observed several dead specimens sold as food on fishermen's markets at Lambaréné, which suggests that its present distribution in Gabon might be wider. The status of this species in Gabon should be urgently evaluated.

Osteolaemus t. tetraspis was inventoried from six parks, recorded from less than 15 km from Crystal Mountains N. P. (Pauwels et al., 2002b), and found on the border area of Ivindo N. P. (Knoepffler, 1974). In Gabon this species is widespread (see also Waitkuwait, 1985) and still common (pers. obs.) and will probably be found in every park.

Varanus niloticus is recorded from Gabon without exact locality (Böhme and Ziegler, 1997). In fact the decree was published before the revision of the *Varanus niloticus* species complex by the latter authors who demonstrated that *Varanus niloticus ornatus* had to be raised to full species status. From a zoogeographical point of view, the confirmation of the presence of the savanna-dwelling *V. niloticus* in Gabon would be very interesting, since that population would be isolated (see map in Böhme and Ziegler, 1997) and efforts could be made to study its exact distribution and taxonomic status. However, at the time the decree appeared, it was probably meant to protect what was later shown to be *V. ornatus*, which is very widespread and abundant in Gabon (see also Böhme and Ziegler, 2004; Pauwels et al., 2002a; 2002b), in cities as well as in cultivated lands, primary forests, savannas and beaches, and already known to occur in six national parks.

Python sebae was already recorded from not less than six parks, and is thus very satisfactorily represented. Like *Varanus ornatus*, it is very common everywhere in Gabon and will probably be recorded soon from all parks.

Representation of internationally-protected species.— Two international conventions on fauna conservation were ratified by Gabon on the same day (laws of 29 July 1987 and decrees of 30 May 1988): the Convention of Algiers and the Convention on International Trade of Endangered Species of Wild Flora and Fauna (CITES; see Anonymous, 1987a-b). The African Convention for Nature Conservation was signed in Algiers on 15 September 1968. This convention presents two levels of protection: total (A) and partial (B). All Cheloniidae and Dermochelyidae are listed in class A, and all crocodilians in class B. The terms of the Con-

vention of Algiers were never concretely applied in Gabon. CITES species for Gabon were listed by Anonymous (2005), with mention of IUCN categories in case of listing. In Appendix I: *Chelonia mydas* (EN – A1abd), *Eretmochelys imbricata* (CR - A1abd+2bcd) (Cheloniidae), *Dermochelys coriacea* (CR – A1abd) (Dermochelyidae), *Crocodylus cataphractus* (DD) and *C. niloticus* (Appendix I/II), *Osteolaemus tetraspis* (VU – A2cd) (Crocodylidae); and in Appendix II: *Kinixys belliana* Gray, 1831, *K. erosa* (DD), *K. homeana* Bell, 1827 (DD) (Testudinidae), *Chamaeleo africanus* Laurenti, 1768, *C. camerunensis* (Müller, 1909), *C. chapini* de Witte, 1964, *C. cristatus* (Stutchbury, 1837), *C. dilepis* (Leach, 1819), *C. gracilis* Hallowell, 1842, *C. oweni* Gray, 1831 and *C. quilensis* Bocage, 1866 (Chamaeleonidae), *Varanus niloticus* and *V. ornatus* (Varanidae), *Calabaria reinhardtii* (Schlegel, 1851) (Boidae) and *Python sebae* (Pythonidae). Although *Caretta caretta* (Linnaeus, 1758) and *Lepidochelys olivacea* are not listed for Gabon by Anonymous (2005), all Cheloniidae, thus including those two species, are listed on Appendix I on http://www.cites.org/eng/app/appendices.shtml (last visited by us on 2 April 2005). The species that are also locally protected are treated in the section above.

Chelonia mydas was recorded from three of the four Gabonese coastal national parks, so its representation is satisfying, but its conservation status is, however, alarming, due to the enormous human predation pressure. In 2004 we (OSGP and J. P. Vande weghe) observed on several occasions numerous green turtle carcasses near Cap Esterias where the species is still commonly and openly offered in restaurants. This happened just a few km from Akanda N. P. It is obvious that such an exploitation is unsustainable. Maran (2002) was even offered a carapace of *C. mydas* to buy near Makokou, about 400 km inland.

Eretmochelys imbricata and *Lepidochelys olivacea* are respectively known from one and two coastal parks in Gabon (see Table 1). They are rare and preyed upon by humans; a detailed summary of the exploitation was presented by Fretey (2001).

Although a few records of *Caretta caretta* were reported from Gabon (Dijkstra, 1993; Fretey, 2001), the current presence of the species should be evaluated.

Kinixys erosa is heavily hunted in Gabon, but is widespread and still very common (see a.o. Maran, 2002:62-63). It is already known from five national parks. The status of *Kinixys belliana* and *K. homeana* in Gabon has still to be evaluated. Neither of these two latter species was listed by Maran (2002), who restricted his list to the available museum material and personal field observations (Maran, pers. comm., Apr. 2005), and of both, only *K. homeana* was listed by Frétey and Blanc (no date). Both species might, however, be eventually documented from Gabon through additional field work, particularly in savanna (*K. belliana*) and in the forests near Equatorial Guinea (*K. homeana*) (Maran, pers. comm.).

The distribution and conservation status of *Chamaeleo* spp. in Gabon is very poorly known, and only *C. dilepis* was reported from a national park (see Table 1). Anonymous (2005) listed *C. camerunensis*, but this species was not included by Frétey and Blanc (no date).

Calabaria reinhardtii is very common in Gabon, especially in secondary forest, and is not eaten by locals (pers. obs.), nor does it seem to be under any other specific threat. It was so far recorded from three parks, but should be found in most.

Suggestions for modifications to the Gabonese protection laws on reptiles.— Due to currently available data on distributions, conservation status and human consumption of reptiles in Gabon (including Billes, 2004; Gramentz, 1999; Lahm, 1993; Mengome Ango, 1998; Steel, 1994), we suggest the following changes from the decree 189/PR/MEFCR of 4 March 1987 relative to their protection: a) *Dermochelys coriacea* and *Crocodylus cataphractus* be integrally protected; b) all Cheloniidae (including *Caretta caretta*) be partly protected; c) *Varanus niloticus* and *Python sebae* be withdrawn from the list of locally-protected species; d) *Cycloderma aubryi* be added to the partly-protected species.

Unprotected areas of demonstrated herpetological interest.— Field surveys that took place out of the established national parks showed two particular sites to be of special herpetological interest, both cited by Anonymous (2002a;

2002b): Mount Iboundji, in the middle of the *Massif du Chaillu*, and the Rabi oil field, lying between Loango and Moukalaba-Doudou national parks. Mount Iboundji is described by Anonymous (2002b:11) as a "rocky tableland overlooking forest rich in biological diversity." It is specified (loc. cit.:87) that new species of reptiles were discovered on its flanks, which are actually those found by Pauwels et al. (2002a): *Hemidactylus kamdemtohami* and *Letheobia pauwelsi*. While the former is currently recorded from three countries (Pauwels, 2004b), the *Letheobia* is still known only from a single specimen. Since two new reptile species and other uncommon taxa (such as the endemic bufonid *Werneria iboundji* Rödel, Schmitz, Pauwels and Böhme, 2004) were discovered during the short time dedicated to the herpetological study of the mountain, we can reasonably expect that intensive surveys will lead to many additional interesting findings. Mount Iboundji has been proposed as a "Sanctuary", a term that Anonymous (2002b:11) defined as: "area high in biological diversity or of special interest too small for National Park status." According to the law, the surface of a national park can not be less than 1000 hectares (Anonymous, 2002a:9; this being not specified in the English version of the book).

The Rabi oil field was intensively herpetologically explored in 2002-3, and proved to be exceptionally rich (Branch et al., 2003; Burger et al., 2002; Lavoué et al., 2003; Pauwels et al., 2005), with not less than 66 species documented, i.e., so far the longest list for any locality in Gabon. Although hunting is presently locally strictly forbidden, and access and logging controlled by the oil company Shell Gabon, the question remains of what will become of this area when declining reserves force the company to leave. Lake Divangui is situated at direct proximity to the Rabi oil field, and was shown to harbor an important population of *Crocodylus cataphractus* (Pauwels et al., 2003); it is also home to *Osteolaemus t. tetraspis* (Barr et al., unpubl. data).

Among the four other exceptional sites mentioned by Anonymous (2002a-b), i.e., Wonga-Wongué Reserve and the adjacent Ogooué Wetlands, "Northeast," and Minkol-Makok inselbergs, none has so far benefitted from a dedicated herpetological survey, and the scarce data currently available do not allow pertinent evaluation. However, one might expect inselbergs to house zoogeographically-interesting and possibly-unique taxa. One of the only two known localities for the endemic legless skink *Feylinia boulengeri* is situated in the Ogooué Wetlands which were also shown to be home for at least five terrestrial and freshwater turtles: *Pelusios castaneus* (Schweigger, 1812), *P. niger* (Duméril and Bibron, 1835), *Cycloderma aubryi*, *Trionyx triunguis* (Forsskål, 1775) and *Kinixys erosa* (see Gramentz, 2001; Maran, 2002). We suggest an evaluation of the current populations of crocodiles and freshwater turtles in this area.

CONCLUSION

Although the 13 recently established national parks seem to represent all the major biotopes of Gabon, it is not yet demonstrated that all unique reptile species of Gabon are included. None of the four endemics and only one of the three near-endemics are recorded so far from a national park in Gabon. Specific surveys should be conducted for these species in convenient biotopes of possible occurrence in the parks. Although improbable, if high search efforts seem to demonstrate that they are not present in any park, conservation measures should be taken, notably through the proposition of sanctuaries for localities where these species do occur.

The numbers of species recorded to date from the parks of Gabon vary from one to 44. These numbers reflect more the search effort than real differences in diversity. However, some parks can be expected to be home to more taxa than others on the basis of their biotope diversity and the presence of altitudinal areas, with more chances to discover taxa new to science in the latter zones. Akanda, Pongara and especially Mayumba national parks show a low diversity of biotopes, no altitudinal zones, and probably house the lowest numbers of species. Bateke Plateaux, Ivindo, Loango, Lopé, Moukalaba-Doudou, Mwagne and Waka national parks should show a higher diversity, due to their wider representation of biotopes. The most diverse and original herpetofaunas are probably

to be found in Crystal Mountains, Minkebe and Mount Birougou national parks, which show peaks above 900 m asl. and particular biotopes such as inselbergs (Minkebe), caves (Birougou) or waterfalls.

All four Gabonese endemic reptiles are small-sized fossorial species known from one to six specimens, and from one to two localities. This indicates a paucity of herpetological knowledge for the country, and suggests high likelihood of discovering additional endemic taxa.

The herpetological inventory of the parks of Gabon is at its beginning and is hence, totally incomplete. In order to raise the proportion of species represented in the parks, we would encourage surveys a.o. in Bateke Plateaux N. P. to search for more savanna species, and possibly new records for the national list. All parks comprising altitudinal zones should be explored since they might reveal new taxa for science, and caves, waterfalls and inselbergs should be systematically inventoried.

In the frame of the current development of Gabon for ecotourism, several parks seem particularly well-placed because they simultaneously offer landscapes which are unique within Gabon and are logistically feasible. These are Loango, Lopé, and Crystal Mountains, three of the four parks for which preliminary reptile lists are already available. Abundances of sea turtles and Dwarf and Nile crocodiles are among the highlights of Loango N. P. Lopé offers a rich lowland and savanicolous herpetofauna, and is situated in close proximity of the exceptional site- Mount Iboundji- which we strongly suggest for protection integrally. The Crystal Mountains harbour a rich mid-altitude herpetofauna, including regional endemics. These three parks combined offer an opportunity to view a wide portion of the Gabonese herpetofauna. Among unprotected areas, Rabi offers so far the richest known assemblage of lowland forest reptile species and is situated in direct proximity to Lake Divangui, a perfect place to observe large numbers of *Crocodylus cataphractus* and a potential sanctuary for the species. Potential impacts of ecotourism on crocodiles and their nesting should of course first be evaluated. It is evident that some reptiles could play a positive role in ecotourism, in particular sea turtles and crocodiles in coastal parks, should protection laws be adequately and quickly enforced. A revision of the list of protected reptile species is also becoming a necessity.

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