

## IKPAN WETLAND RAINFOREST: AN AREA OF HIGH BIODIVERSITY IMPORTANCE IN SOUTH-EASTERN NIGERIA

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### RÉSUMÉ

Un inventaire détaillé des mammifères, reptiles et amphibiens a été conduit dans les zones humides et de forêt de terre ferme du bloc forestier d'Ikpan (Cross River State, sud-est du Nigéria) durant la période 1998-2001. Les prospections ont montré que l'Ikpan Forest, bien que formellement non protégée tant au niveau régional qu'au plan national, héberge une remarquable biodiversité qui inclut de nombreux vertébrés de grand intérêt écologique et biogéographique et qui sont importants en termes de conservation. Parmi les mammifères, les taxons les plus importants sont les primates (11 espèces différentes dont *Mandrillus leucophaeus*, *Pan troglodytes*, *Procolobius badius preussi*), les éléphants et les buffles de forêt et beaucoup d'ongulés. Des lamantins et des panthères sont vraisemblablement aussi présents. Parmi les reptiles, *Osteolaemus tetraspis*, *Kinixys* spp., *Varanus niloticus ornatus*, *Python sebae*, et des caméléons sont particulièrement importants du point de vue de la conservation. De plus, cette forêt abrite une remarquable diversité d'espèces de serpents (27) et d'amphibiens (27), dont beaucoup sont de bons indicateurs de qualité écologique forestière et certaines n'avaient fait l'objet jusqu'ici que de rares mentions au Nigéria (e.g. les anoures *Bufo superciliaris* et *Conraua crassipes*). La zone montre de grandes potentialités en matière de conservation et de développement durable (écotourisme) mais doit être soigneusement gérée dans les toutes prochaines années pour éviter les effets négatifs de l'exploitation forestière, de la chasse locale, de l'agriculture et de la pêche à la dynamite.

### SUMMARY

A careful survey for mammals, reptiles, and amphibians, was conducted at the wetlands and rainforests of Ikpan Forest block, Cross River State (south-eastern Nigeria), during the period 1998-2001. The surveys proved that Ikpan Forest, although formally not protected at either regional or national levels, houses an extraordinarily rich biodiversity, including many vertebrates of ecological, biogeographic, and conservation importance. Among mammals, the most important taxa are primates (11 different species, including *Mandrillus leucophaeus*, *Pan troglodytes*, *Procolobus badius preussi*), forest elephants, forest buffalos, and many ungulates. Manatees and leopards may also be present. Among reptiles, *Osteolaemus tetraspis*, *Kinixys* spp., *Varanus niloticus ornatus*, *Python sebae*, and chameleons are especially important in conservation terms. Moreover, the study forest houses a conspicuous

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diversity of species of snakes (27) and amphibians (27), including many species which are good ecological indicators of forest quality, and some species which were rarely recorded in Nigeria before (e.g., the anurans *Bufo superciliaris* and *Conraua crassipes*). The study area has potentials for conservation and sustainable development (eco-tourism), but should certainly be monitored carefully in the next years to avoid the negative effects of timber extraction, local hunting, farming, and fishing with dynamites.

## INTRODUCTION

According to Ramsar Convention Bureau's definition (1997), wetlands are "areas of marsh, fen, peat-land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters". According to the United States Department of Fish and Wildlife Services (1979), there are six major categories of wetlands, all of them with important examples inside the political territory of the Federal Republic of Nigeria (Singh *et al.*, 1995). Marine wetlands are well represented by Lagos-Lekki lagoons, estuarine wetlands by Stubbs Creek Forest Reserve (Akwa-Ibom State) and Bakasi Peninsula (Cross River State), lacustrine wetlands by Hadejia Nguru and Lake Chad, palustrine wetlands by Niger Delta marshes, artificial wetlands by Festac Town Canal, Lagos, and riverine wetlands by, e.g., Ikpa River and Ikpan Forest block. Therefore, Nigeria is a country of exceptional importance for wetlands, and also an important hotspot for biodiversity, especially in the south-eastern part of the country where rainforest and mangrove forest blocks are found (Singh *et al.*, 1995; Olajide & Eniang, 2000), and where several endemic taxa are found in many faunal and floral groups (Kingdon, 1990).

Among the remnant rainforest wetlands of south-eastern Nigeria, the Ikpan Forest block appears to be a truly extraordinary important biodiversity hotspot, but nevertheless it has been almost totally forgotten by previous ecological research in this part of Africa. However, because of the importance of its natural resources, it should certainly be categorized among the most important areas of the Nigeria-Cameroon (= Biafran) forest block. In this paper, we present the results of a long-term ecological survey of the Ikpan Forest block, with emphasis on the populations of medium to large-sized mammals, reptiles and amphibians, and with conservation and management implications. We would strongly urge, by means of the present scientific paper, the international conservation community and the Federal Government of Nigeria to adopt immediate and serious conservation measures for the preservation of this extraordinary Afrotropical wetland area.

## MATERIALS AND METHODS

### STUDY AREA

The Ikpan Forest block is situated, in the Cross River State (capital city: Calabar), on longitudes 08° 35'-08° 45' E, and latitudes 05° 00'-05° 15' N. It is a typical riverine wetland ecosystem, which has a system of four major rivers (*i.e.* Ebe, Akpa Yafe, Akpa Korup, and Ikpan), over 8 permanent streams, and 12

seasonal streams with tributaries traversing the entire length and breadth of the forest. It is the forest block adjacent to Korup National Park in Cameroon, and falls originally under the Oban Hills Forest Reserve. Ikpan forest block covers approximately 100 km<sup>2</sup> of rainforest, either disturbed or even undisturbed. The environmental conditions of the Ikpan forests are similar to those of the Oban forests, although slightly different in botanical composition. The plant species found in approximately 70 % of the forested territory include, but are not limited to, members of the families Caesalpiniaceae, Mimosaceae, Papilionaceae, Rubiaceae, Lecythidaceae, Palmae, Euphorbiaceae and Bignoniaceae. The rest 30 % is secondary forest and the trees found belong to families such as Mimosaceae, Rhizophoraceae, Meliaceae, Palmae, Moraceae, Rutaceae, Euphorbiaceae and Bignoniaceae. From amongst this great diversity of tropical timber species, are some trees of high economic value still existing in some of the relatively undisturbed forest patches. The prevailing wetness of those ecosystems for most of the year has made commercial timber logging a difficult venture in the area, which has saved wide sectors of this remarkable forested block. In fact, it is easily observed that the remnant intact forests of Cross River State (including this one) are those to be found in very difficult terrains that neither facilitate logging, agriculture, nor infrastructural development. Moreover, our study area is either too hilly, rocky, mountainous and swampy for being extensively used for human industry practices. Thus, on a typical forest survey plot, there is still a significant density of large trees with about 260 stems greater than 30 cm diameter at breast height (dbh) per hectare, and about 45-65 stems of 1 m and above dbh per hectare.

The people impacting directly on the Ikpan forest are mainly from Ekonganaku community, which is the major human settlement within the area. They are a migrant tribe who settled in Ikpan forest block, about 1904, from the Korup tribe of Cameroon. Farming, hunting, and gathering of wild fruits and other non-timber forest products are their major occupations.

## METHODS

A long-term research study (years 1998-2001) was conducted at the study area. The research study was conducted in three main phases as follows:

(1) *Reconnaissance Survey*. — The research team went into the area in December 1998, for a 12-days-long preliminary survey, to familiarize with the area, people, and accesses to see if it was feasible to undertake a long-term field ecological research. At the end of the visit, it was accepted as a potential project site and a pilot study was embarked upon.

(2) *Pilot Study*. — A pilot study lasting three months (September-November 1999) was undertaken. A simple “broad sweep survey” of the entire area was used as study method, with recording of all the mammals, reptiles, amphibians, and of several birds, encountered. The study team was divided into two groups, and different areas of the forest were surveyed simultaneously, either during daylight and night hours, in sunny as well as in rainy days, with a view to narrow down the scope and concentrate on the most viable areas.

(3) *Final Research Period*. — After three months of pilot study, three principal areas were selected for intensive studies. They were: (i) the Erat road area downstream of Akpa Korup River, (ii) Ekon road area (north-east of Ekonganaku village), and (iii) the north-eastern upstream of Akpa Korup River.

A base camp was established in each of the three selected areas, and three transects of 4 km (a standard length established for the transects in all the chosen locations) were followed in each of the selected areas. The three transects were located on the ground, and on a map of the area in such a way that each was cut across the forest, without falling outside the study site. After cutting the whole length, it was left for two weeks before sampling was embarked upon. Two field camps which were close to our transects (< 500 m away) were relocated to prevent noise from the camp reaching the transect and influencing faunal activities. Since the study area has been subjected to hunting by local people persistently for many years, the animals were very shy, hence the need to leave the transects for at least two weeks after initial cutting. Research equipment included the prismatic compass, the Global Positioning System (GPS) "Garmin 12", binoculars, photo-cameras, video cameras, camping kits/equipment, cooking utensils, etc.

For efficient sampling, two people walked along the transect silently, one 50 m ahead of the other. The first was watching for arboreal animals, and the second, coming behind, for ground animals. Movement was steady with a maximum speed of  $1 \text{ km} \times \text{hour}^{-1}$ , stopping frequently, and watching left and right, and listening for calls. Signs of human activities, e.g. hunting or harvesting of non-timber forest products, were noted. Snare-traps, spent shotgun cartridges, and carbide dumps were also noted. Animal feeding signs, foot prints, tracks, etc., were recorded. Such locations were quickly determined by the use of GPS, and the relative coordinates were located on the map. In addition, specimens already dead at the time of observation (e.g. snakes killed by people, etc.), were preserved in alcohol for later examination of their stomach contents, etc. Moreover, photographic records for the most important species have been deposited at the University of Uyo, Department of Agricultural Sciences.

The whole research aimed at establishing the terrestrial vertebrate faunal composition of the highly important Ikpan forest block, but did not try to establish the density and population abundance of the various species, for which much more long research should have been planned.

## RESULTS AND DISCUSSION

### MAMMALS

The list of mammal species observed directly in the study area is presented in Table I. This list does not include bats and small mammals (small sized rodents and shrews), which are often of problematic identification and may require specialists' examination. The area proved to have the highest primate diversity in the Cross River State region. The area proved to be inhabited by at least 11 resident primate species (see Table I), all practically sympatric. This number of primate species is nearly identical to that observed by Oates *et al.* (1990) in the Okomu forest (western Niger Delta, southern Nigeria), and is almost equal to the total number of species observed in the whole eastern Niger Delta (*i.e.* 12 species, *cf.* Angelici *et al.*, 1999a). Drills and chimpanzees are certainly among the most important primates of the study area due to their endangered status (Oates, 1986; Gippoliti & Carpaneto, 1995), but it is also noteworthy that *Procolobus badius preussi* was just confirmed to occur here (first recent record as for Nigeria is

TABLE I

List of the mammal species observed at the Ikpan Forest. Local names (from both Efik and Korup people) are also included.

| ENGLISH NAME               | SCIENTIFIC NAME                    | EFIK NAME      | KORUP NAME   |
|----------------------------|------------------------------------|----------------|--------------|
| <b>Primates</b>            |                                    |                |              |
| Preuss' red colobus        | <i>Procolobus badius preussi</i>   | Okoyo ebok     | Konimnwok    |
| Red eared guenon           | <i>Cercopithecus erythrotis</i>    | Adat Isim ebok | Onkoot       |
| Crowned guenon             | <i>Cercopithecus pogonias</i>      | ?              | Komfong      |
| Mona monkey                | <i>Cercopithecus mona</i>          | Awanda ebok    | Enkei/bunker |
| Putty nose guenon          | <i>Cercopithecus nictitans</i>     | Ubit ebok      | Obin         |
| Red capped mangabey        | <i>Cercocebus torquatus</i>        | Ikpok ebok     | Ikpok ebok   |
| Drill                      | <i>Mandrillus leucophaeus</i>      | Nsimbo         | Etom         |
| Chimpanzee                 | <i>Pan troglodytes</i>             | Idiok          | Konou/Konow  |
| Angwantibo                 | <i>Arctocebus calabarensis</i>     | Angwantibo     | Kabia        |
| Needle-clawed galago       | <i>Euticus elegantulus</i>         | Nsama          | Kombom       |
| Demidoff's galago          | <i>Galagoides demidoffi</i>        | ?              | Kombom       |
| <b>Insectivores</b>        |                                    |                |              |
| Giant otter shrew          | <i>Potamogale velox</i>            | Ekwek          | ?            |
| <b>Rodents</b>             |                                    |                |              |
| Beecroft's flying squirrel | <i>Anomalurus beecrofti</i>        | Efe            | ?            |
| Gambian giant rat          | <i>Cricetomys gambianus</i>        | Eyot           | ?            |
| Brush tailed porcupine     | <i>Atherurus africanus</i>         | Ebiong         | ?            |
| African dormouse           | <i>Graphiurus murinus</i>          | ?              | ?            |
| <b>Carnivores</b>          |                                    |                |              |
| Marsh mongoose             | <i>Atilax paludinosus</i>          | Nkukwa         | ?            |
| Flat-headed cusimanse      | <i>Crossarchus platycephalus</i>   | ?              | ?            |
| Ichneumon mongoose         | <i>Herpestes ichneumon</i>         | ?              | ?            |
| Forest genet               | <i>Genetta cristata</i>            | ?              | ?            |
| <b>Scaly ant-eaters</b>    |                                    |                |              |
| Giant pangolin             | <i>Manis gigantea</i>              | Akwa ekara     | ?            |
| Tree pangolin              | <i>Manis tricuspis</i>             | Ekara          | ?            |
| <b>Hyraxes</b>             |                                    |                |              |
| Western tree hyrax         | <i>Dendrohyrax dorsalis</i>        | Awawa          | ?            |
| <b>Proboscids</b>          |                                    |                |              |
| African forest elephant    | <i>Loxodonta africana cyclotis</i> | Enin           | ?            |
| <b>Ungulates</b>           |                                    |                |              |
| Blue duicker               | <i>Cephalophus monticola</i>       | Aso            | ?            |
| African buffalo            | <i>Syncerus caffer nanus</i>       | Enang ikot     | ?            |
| Sitatunga                  | <i>Tragelaphus spekei</i>          | Edop           | ?            |
| Water chevrotain           | <i>Hyemoschus aquaticus</i>        | Edop idim      | ?            |
| Red river hog              | <i>Potamochoerus porcus</i>        | Edi ikot       | ?            |

concerned) in 1999 (Eniang, 1999; Eniang & Nwufoh, 2000). Bush-babies appeared also very abundant in the study area (E.A. Eniang *et al.*, unpublished data).

Among the other mammals, the forest elephant is possibly the most relevant taxon in conservation terms. This species appeared rare in the study area, as well as in other forest areas of south-eastern Nigeria, but is still subjected to illegal hunting by groups of native hunters (Tooze, 1994; Schmitt, 1996). Noteworthy is also the presence of *Genetta cristata*, a rare carnivore species which is endemic of the Nigerian-Cameroon border (Powell, 1997; Angelici *et al.*, 1999b; Angelici,

2000), and which appears not uncommon here. The rest of the mammal fauna observed is quite typical of the swamp-forest habitats of south-eastern Nigeria, and includes species which are relatively abundant and widespread (e.g., see Angelici *et al.*, 1999a). Although not directly observed by us, the manatee (*Trichechus senegalensis*) may be present in the river system of the study area, as it has been perfectly described by natives (with the Efik name of "Ituh"). According to natives, manatees should be very rare in the study area. The leopard (*Panthera pardus*), recorded in the adjacent Cross River National Park (Schmitt, 1996), may occur also in the study area, but firm evidence of its presence has not been obtained.

## REPTILES

The list of reptile species observed directly in the study area is presented in Table II. The species diversity of reptiles was, exactly as it was the case of mammals, exceptional. In fact, within the single forest area, we were able to establish the presence of 1 crocodylian, 4 chelonians, 14 saurians, and 27 snakes (Table II). Comparisons with available literature data indicate that Ikpan forest alone housed, if contrasted with the whole Niger Delta territory (see data in Akani *et al.*, 1999; Luiselli *et al.*, 2000), 1/3 of the total number of crocodylian species, 4/7 of chelonian species, and 26/36 snake species, including also some species (e.g., *Thrasops jacksonii*) which were not observed in Niger Delta. Moreover, if we compare the snake-fauna richness of Ikpan Forest with that of other forest regions currently protected in Nigeria, the exceptional diversity of Ikpan can be easily seen: the total number of snake species was in fact 27 in Ikpan, *versus* 21 species in the Upper Orashi Forest Reserve in Rivers State (Akani *et al.*, 1999), 24 species in Stubbs Creek Reserve in Akwa-Ibom State (Luiselli *et al.*, 1998), and 41 species in Cross River National Park (Schmitt, 1996, but it should be noted that this number is likely much exaggerated due to some identification errors; Luiselli *et al.*, unpublished data from checking of preserved specimens in the National Park collections, Akamkpa, Butatong and Calabar). The reptile fauna includes typical species assemblages of lowland rainforest, but is indeed remarkable in that nearly all the species typically linked to mature forests have been observed here (e.g., *Bitis nasicornis*, *Pseudohaje goldii*, *Thrasops jacksonii*, just to cite a few). Noteworthy is also the sympatric occurrence of three chameleon species, as these lizards are rare and generally threatened in Nigeria (Politano, 1998). Other important species in conservation terms are *Osteolaemus tetraspis* (Akani *et al.*, 1999), *Kinixys erosa*, *K. homeana* (Lawson, 2000), *Varanus niloticus ornatus* (Buffrénil, 1991) and *Python sebae* (Luiselli *et al.*, 2001). Concerning the diversity of snakes, it is important to stress that the Ikpan Forest community includes species with very different feeding habits, including species preying on practically every type of small and medium-sized vertebrate, from tadpoles to fish, from frogs to lizards, from snakes to rodents, and from birds to monkeys (Luiselli *et al.*, 1998, 2001), which is a very good indicator of environmental quality as snakes are very good ecological indicators in this respect (Luiselli & Akani, in press).

## AMPHIBIANS

The list of amphibians is more tentative than those of mammals and reptiles, due to (i) the difficulties in correctly identifying several species in the absence of

TABLE II

List of the reptile species observed at the Ikpan Forest. Local names (from Efik people) are also included. Korup name was not recorded.

| ENGLISH NAME                 | SCIENTIFIC NAME                      | EFIK NAME         |
|------------------------------|--------------------------------------|-------------------|
| <b>Crocodylians</b>          |                                      |                   |
| Dwarf crocodile              | <i>Osteolaemus tetraspis</i>         | Iba               |
| <b>Chelonians</b>            |                                      |                   |
| Serrated hinge-back tortoise | <i>Kinixys erosa</i>                 | Ikut Akai         |
| Home's hinge-back tortoise   | <i>Kinixys homeana</i>               | Ikut Akai         |
| African softshell turtle     | <i>Trionyx triunguis</i>             | Ikut Inyang       |
| West African black turtle    | <i>Pelusios niger</i>                | Ikut Mmong        |
| <b>Saurians</b>              |                                      |                   |
| Forest Nile monitor lizard   | <i>Varanus niloticus ornatus</i>     | Utai              |
| Forest banded gecko          | <i>Hemidactylus fasciatus</i>        | Ukpong eyen akai  |
| House gecko                  | <i>Hemidactylus brooki angulatus</i> | Unipong eyen      |
| ?                            | <i>Hemidactylus intestinalis</i>     | Unipong eyen      |
| ?                            | <i>Lygodactylus conraui</i>          | ?                 |
| ?                            | <i>Mabuya polytropis</i>             | Edun dun          |
| ?                            | <i>Mabuya affinis</i>                | Edun dun          |
| ?                            | <i>Mabuya maculilabris</i>           | Edun dun          |
| ?                            | <i>Mochlus (Riopa) fernandii</i>     | Aasaukumi         |
| ?                            | <i>Panaspis togoensis</i>            | ?                 |
| ?                            | <i>Panaspis breviceps</i>            | ?                 |
| Pigmy chameleon              | <i>Rhampholeon spectrum</i>          | Ekpri Akube       |
| Owen's chameleon             | <i>Chamaeleo owenii</i>              | ?                 |
| Crested chameleon            | <i>Chamaeleo cristatus</i>           | ?                 |
| <b>Snakes</b>                |                                      |                   |
| Blind snakes                 | <i>Typhlops</i> sp.                  | ?                 |
| African rock python          | <i>Python sebae</i>                  | Asabo             |
| Royal python                 | <i>Python regius</i>                 | Ekpri Asabo       |
| Calabar ground python        | <i>Calabaria reinhardtii</i>         | Iwod iba          |
| Gaboon viper                 | <i>Bitis gabonica</i>                | Mkpi ibom         |
| Rhinoceros viper             | <i>Bitis nasicornis</i>              | Ibom              |
| Green bush viper             | <i>Atheris squamiger</i>             | ?                 |
| Night adder                  | <i>Causus maculatus</i>              | ?                 |
| Jameson's green mamba        | <i>Dendroaspis jamesoni</i>          | Awawa ikon ikpong |
| Tree cobra                   | <i>Pseudohaje goldii</i>             | Ebre              |
| Spitting cobra               | <i>Naja nigricollis</i>              | Ebre              |
| Black forest cobra           | <i>Naja melanoleuca</i>              | Ebre              |
| West African vine snake      | <i>Thelotornis kirtlandii</i>        | ?                 |
| Olive-green sand snake       | <i>Psammophis cf. phillipsi</i>      | ?                 |
| ?                            | <i>Thrasops flavigularis</i>         | Ebre              |
| ?                            | <i>Thrasops occidentalis</i>         | Ebre              |
| ?                            | <i>Thrasops jacksonii</i>            | Ebre              |
| Smith's water snake          | <i>Grayia smythii</i>                | Uta iyak          |
| African marsh snake          | <i>Afronatrix anoscopus</i>          | ?                 |
| Collared marsh snake         | <i>Natriciteres fuliginoides</i>     | ?                 |
| Variable marsh snake         | <i>Natriciteres variegata</i>        | ?                 |
| Emerald snake                | <i>Gastropyxis smaragdina</i>        | ?                 |
| Green bush snake             | <i>Philothamnus</i> spp.             | ?                 |
| West African file-snake      | <i>Mehelya crossii</i>               | ?                 |
| Forest file-snake            | <i>Mehelya poensis</i>               | ?                 |
| House rat-snake              | <i>Lamprophis fuliginosus</i>        | ?                 |
| Olive house rat-snake        | <i>Lamprophis olivaceus</i>          | ?                 |

call recording and detailed comparative voucher materials, and (ii) the elusive habits of most species, which have a very short above-ground activity cycle. Thus, here we include only the species that were carefully identified, plus some other species still unidentified by us, but with genus attribution carefully established. Only anuran amphibians were found in the study area, although, based on interviews of local hunters, we cannot exclude the presence of caecilians. Caecilians have been rarely reported for Nigerian rainforests (e.g., see Schiøtz, 1963, 1966), but are well known in the adjacent Cameroon (e.g., see Perret, 1966) and a few specimens are stored in the collections of the Cross River National Park at Butatong. In total, 27 anurans were collected at the Ikpan Forest. The anuran species collected at the study area were: *Silurana (Xenopus) tropicalis* (Pipidae), *Bufo camerunensis*, *B. regularis*, *B. maculatus*, *B. gracilipes*, *B. superciliaris*, *Nectophryne afra* (Bufonidae), *Ptychadena cf. aequiplicata*, *P. oxyrhynchus*, *P. longirostris*, *Hoplobatrachus occipitalis*, *Hylarana albolabris*, *Conraua crassipes*, *Phrynobatrachus auritus*, *Phrynobatrachus* sp. 1, *Phrynobatrachus* sp. 2 (Ranidae), *Arthroleptis* sp. 1 (Arthroleptidae), *Afrixalus dorsalis*, *A. (congicus) paradorsalis*, *Acanthixalus spinosus*, *Hyperolius cf. ocellatus*, *H. sylvaticus*, *Hyperolius* sp. 1, *Hyperolius* sp. 2, *Leptopelis notatus*, *L. cf. viridis*, *Leptopelis* sp. 1 (Hyperoliidae). Some of these species were already recorded in localities close to our study area: for instance, *Afrixalus (congicus) paradorsalis* and *Hyperolius ocellatus*, among the others, were captured at Osomba (Schiøtz, 1967, 1999), a small village situated inside the territory of the Cross River National Park. Among these species, the biogeographically more important ones appear to be *Bufo superciliaris* and *Conraua crassipes*, both rarely recorded in Nigeria during earlier surveys. The former species, which may attain very big size in Ikpan, was collected by us inside primary forest, on a leaf litter substratum. Also previous literature on this species is in agreement in considering it as a species present only in primary forests (e.g., Lamotte, 1998). The latter species was found in the rocky spots along streams in the primary forest zone, and was observed in small groups of 2-5 adults at a site. Based on interviews with local hunters, we may suspect the occurrence at Ikpan also of the goliath frog (*Conraua goliath*), which, however, was not observed during our surveys. In this regard, we could not exclude that the hunters' reports were relative to large *Bufo superciliaris* or, more likely, *Hoplobatrachus occipitalis*.

## CONCLUSIONS

In conclusion, our long-term surveys demonstrated that the Ikpan Forest blocks are crucial areas in south-eastern Nigeria because they house an extraordinary variety of mammals, reptiles, and amphibians, and, likely, of many other faunal and floral groups. For instance, among birds, we recorded the presence of important species such as the parrots *Psittacus erithacus* and *Poicephalus gularis* (which was firstly recorded in Nigeria in 1999, see Eniang, 1999), and, among invertebrates, we can cite an extraordinarily high variety of *Lepidoptera* (cf. Schmitt, 1996).

The exceptional biodiversity of Ikpan Forest certainly calls for the attention of both the Nigerian government institutions and the international environmental and conservation organizations. Its relative vicinity with Calabar, the capital city of Cross River State which has a good international airport and is easily linked



(mostly via Lagos) with other African countries, Europe, Americas, and even Asia and Australia, suggests that Ikpan Forest may have great potentials for eco-tourism development. It may on one side help to conserve the forest, and on the other side improve the economic conditions of the poor people of the area. Bird watching, primate-targeted expeditions, and the splendid landscape elements (*e.g.*, Akwa Yafe waterfall) may be great attractants to eco-tourists.

Certainly, it is however important to avoid that this splendid rainforest environment may be damaged by local and outside stressors. The most important stressors may be: (i) *excessive timber exploitation*, that may be made by commercial timber loggers as the study area is not protected by laws; (ii) *unsustainable hunting and non-timber forest products extraction*, which are linked exclusively to practices by local communities; (iii) *unsustainable farming systems*, due to individual farmers who traditionally take over small forest areas, clear the trees, plant crops, and build farm houses; and (iv) *use of dynamites* to catch fish in the main rivers. All these eventual threats should be carefully monitored, and a priority measure should be to officially include the Ikpan Forest block inside the protected territory of Cross River National Park, or to create a specific protected area for it.

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