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# Preliminary inventory of bats (Mammalia Chiroptera) from Ouesso and Impfondo forests (north of Congo Republic) with three new records for the country

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**ABSTRACT** In order to update the basic data on the species richness of frugivorous and insectivorous bats (Mammalia Chiroptera) living in the northern forests of the Republic of Congo, collections were carried out between March 2021 and September 2023. Black mist nets installed in the treetops at four sites over an 18–month period enabled 567 individuals belonging to 11 species, ten genera and four families to be collected. Fruit bats revealed 11 species of the same family, while insectivorous bats were represented by three species in three families. *Eidolon helvum* (n = 352) was the species most often observed at the various sites. Three species were recorded for the first time in Congo: *Epomophorus intermedius*, *Epomophorus gambianus* and *Saccolaimus peli*.

**KEY WORDS** Bats; Biodiversity; Republic of Congo.

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## INTRODUCTION

Chiropterans are the second most diverse group of mammals after rodents, with around 1,300 described species worldwide (Wilson & Reeder, 2005; Simmons & Cirranello, 2023), 335 of which currently live on the African continent (ACR, 2024). They are the only mammals to have acquired the ability to move through the air by active flight (Sapir et al., 2014).

Chiropterans have a wide geographical distribution, as with the exception of Antarctica, they are found on every continent and the majority of species are found in tropical and subtropical regions of the globe (Riede, 2004). The order of Chiroptera is divided into two suborders:Yangochiroptera and Yinpterochiroptera (Marshall, 1983; Teeling et al., 2002).

They have ecological, economic (Kunz et al., 2011; Kingston, 2013; Meyer et al., 2015), health (Moratelli & Calisher, 2015; Saéz et al., 2015) and conservation (Niamien et al., 2015; Mildenstein et al., 2016; Williams-Guillén et al., 2016) importance. Fruit bats species in particular provide important ecosystem services, contributing to the pollination of flowers and the restoration of forest ecosystems through the dispersal and germination of seeds from consumed fruit. Insectivores help to regulate insect populations (Kunz et al., 2011; Ghanem and Voigt, 2012; Happold & Happold, 2013).

Bats are also known to be major carriers of emerging and re-emerging viruses that are pathogenic to humans and are therefore suspected of being involved in the transmission of zoonotic viruses, although the evidence remains limited to

date and based solely on epidemiological links (Calisher et al., 2006; Towner et al., 2007; Hayman, 2016; Letko et al., 2020).

East Africa is the geographical area with the greatest diversity of bats (Patterson and Webala, 2012). The distribution and diversity of these mammals are still poorly known in many Central African countries (Brosset, 1966; Hill, 1983; Rodriguez et al., 2006). In fact, only two countries in the Congo Basin have carried out major investigations into bats, namely the Democratic Republic of Congo, with 133 species recorded, and Cameroon, with 100 species (Bakwo Fils et al., 2014; Van Cakenberghe et al., 2017; Waghiiwimbom et al., 2020; ACR, 2024).

In the Republic of Congo, only 43 species of chiropteran have been recorded to date (Bergmans, 1979; Bates et al., 2013). Major sampling efforts are still required to improve knowledge of the species richness of chiropterans in this part of the Congo Basin forests. This lack of basic data on the bat fauna of Central Africa is an obstacle to exploiting their ecosystem services in order to include them in tropical ecosystem conservation programs (Bakwo Fils et al., 2014).

This study is a contribution to a better understanding of the bats diversity, in order to ensure their rational and sustainable management. In particular, it aims to highlight the specific composition of the African bat community living in the forests surrounding the two localities in the northern part of the Republic of Congo.

## MATERIAL AND METHOD

### *Study area*

This study took place between March 2021 and September 2023, in the outlying forests of Ouesso and Impfondo, in the north of the Republic of Congo. These two areas were chosen because local people regularly hunt bats. The two study areas are subject to an equatorial climate, with rainfall that covers almost the whole year, with two peaks, the first of which runs from March to May and the second (the greater) from September to November. Two capture sites were located in each study area: Site 1, in the south-east, with coordinates 01°35‘N, 16°03’E, at an altitude of 337 m asl, located in a secondary forest behind the Ouesso sports complex, and site 2, in the north-east with coordinates 01°38‘N, 16°03’E, at an altitude of 334 m asl, located in the gallery forest on the right bank upstream of the Sangha River (Fig. 1). Site 3, with coordinates 01°36‘N, 18°03’E, 318 m, is located at the port, on the right bank of the Oubangui river, and site 4: 01°34‘N, 18°02’E, 328 m altitude, was located in a secondary forest, in the southern periphery of Impfondo (Fig. 2).

### *Biological and field material*

Personal protective equipment consisting of disposable gowns (Tyvek), masks and single-use gloves was used to handle the specimens. A Pesola type graduated spring scale was used to determine the weight of each individual. The wingspan and forearm size of each specimen were measured using a tape measure and a metal ruler respectively (Abedi-Lartey et al., 2016). A Garmin 64st Global Positioning System (G.P.S) was used to record the geographical location of the capture and mating sites.

### *Capture and Species identification*

The bat specimens used in this study were captured using mist nets installed by local teams of bats hunters. The net visits, which lasted 30 or 90 days, took place every morning from 6am, Monday to Saturday, covering a period of 18 months. Species were identified on the basis of morphological characteristics (size, colouration, palatal folds) using identification keys (Bergmans, 1997; Patterson & Webala, 2012; Happold & Happold, 2013). For each specimen, various physical parameters (weight, forearm size and wingspan) were recorded. Sex was determined by direct observation of the presence of the penis in males and the vaginal orifice next to the anus in females. Discrimination between adults and juveniles (immature individuals) was based on differences in weight, forearm size, colouration and the development of secondary sexual characteristics, as indicated by several authors (Mutere, 1967; Racey & Entwistle, 2000).

### *Statistical analysis*

Statistical analyses were carried out using the

open source R environment (R core team, 2019), to estimate the specific dominance of each species according to the sites. We estimated the diversity of the bat community present at each sampling site, using numerical indices such as species richness, which is defined as the number of species collected.

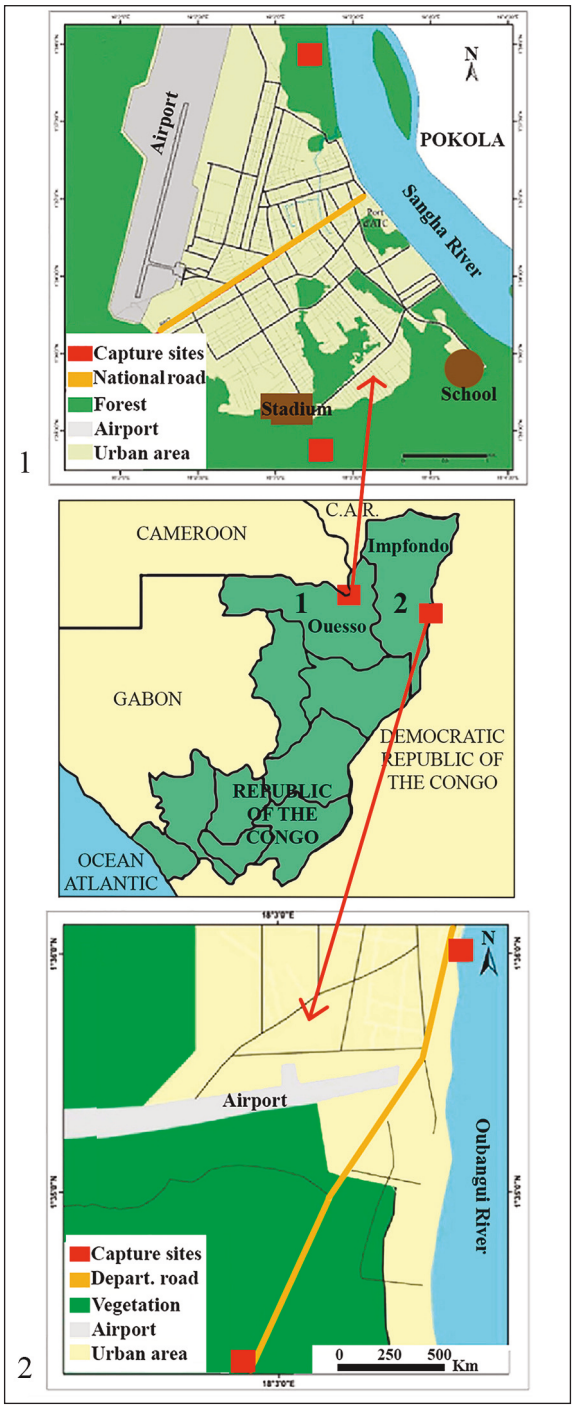


Figure 1, 2. Study area: Ouesso (Fig. 1) and Impfondo (Fig. 2) in Republic of the Congo.

## RESULTS AND DISCUSSION

During the study carried out between March 2021 and September 2023, a total of 567 chiropterans divided into 4 families, 10 genera and 11 species were captured throughout the two study areas (Table 1). Our results show that fruit bats species, grouped in the single family Pteropodidae, were the most represented, with 540 individuals and 8 species at all the sites. Insectivorous bats, which have the greatest biological diversity in the world, with 11 families and more than 193 species living on the African continent (Happold & Happold, 2013; ACR, 2024), were represented in this study by three families.

Similarly, a large number of individuals and species were collected in forest sites rather than in urban areas (Table 1). These observations indicate that forests (secondary and gallery) offer many vital resources to bats. Although some of these species, such as *Eidolon helvum* and *Hypsignathus monstrosus*, are better adapted to urban environments (Mutere, 1967; Fayenuwo & Halstead, 1974), forests are one of the natural habitats of these mammals (Mickleburgh et al., 1992; Monadjem et al., 2010).

### *Systematics*

Familia PTEROPODIDAE Gray, 1821

Genus *Hypsignathus* H. Allen, 1861
***Hypsignathus monstrosus*** H. Allen, 1861

A total of 65 males and 73 females were collected during this study and the largest specimen measured up to 990 mm wingspan, weighing 455g. (Table 2). In both study areas, this species was found in both secondary forest sites (26–28%) and urban areas (25.58%) (Table 1). It was the largest species of this family recorded at all four sites (secondary forest, gallery forest and urban environment). Specimens of this species have been reported from both types of forest habitat in northern and southern Congo (Malbrant & Maclatchy, 1949; Brosset, 1966; Tolovou & Lenga, 2018; Schloesing et al., 2023).

Genus *Epomops* Gray, 1870
***Epomops franqueti*** Tomes, 1860

For this species, 22 individuals, including 13 males, were captured in secondary forest habitats and largely in the gallery forest site, with a relative abundance of 12.03%, much higher than at the other sites (Table 1). Five of the females captured during this study were pregnant (4 individuals in April, May and July; 1 other in October). This species had been recorded in Brazzaville (Malbrant and Maclatchy, 1949), in the Mayombe forest, on Ile Mbamou and in the forests of Odzala National Park (Bergmans, 1979). Collections of *E. franqueti* have also been made in the secondary forests of the lower Kouilou, as well as in the gallery forests on the banks of the Congo River, at Liranga (Seifert et al., 2022).

Genus *Eidolon* Rafinesque, 1815
***Eidolon helvum*** Kerr, 1792

Specimens of this species were the most numerous observed in nets at all sites, with 155 males and 197 females captured. However, a relatively low number of individuals was observed in the urban site at Impfondo, compared with the secondary forest and gallery sites (Table 1). This strong presence in the various terrestrial habitats would indicate the great adaptability of this species and the availability of fruit resources in these forests. As observed by Bergmans (1979), pregnant females were collected between November and January, followed by juveniles in April-June. Known for its seasonal migrations (Richter & Cumming, 2008), *E. helvum* is distributed throughout the sub-Saharan region of the African continent (ACR, 2024). In the Republic of Congo, it was first recorded in the south, in Brazzaville (Malbrant & Maclatchy, 1949; Brosset, 1966; Bergmans, 1979) and then in the north-western forests, in Ewo (Malbrant and Maclatchy, 1949). This species is very abundant on the markets in the two localities (Ouesso and Impfondo) where this study was carried out. The sale of *E. helvum* specimens is a very old practice that has also been observed in Brazzaville and Pointe Noire (Dowsett et al., 1991).

Genus *Myonycteris* Matschie, 1899
***Myonycteris torquata*** Dobson, 1878

During this study, the number of individuals of *M. torquata* was relatively low, 12 females and 7 males were collected in the secondary forest and gallery sites at Ouesso, as well as in the secondary forest site at Impfondo. The first collections of *M. torquata* specimens were made by Brosset, 1966 and Bergmans, 1979 in the southern parts of the country. Three specimens were also captured in the Mayombe by Dowsett et al. (1991).

Genus *Rousettus* Gray, 1821
***Rousettus aegyptiacus*** E. Geoffroy St.-Hilaire, 1810

Reported exclusively from areas covering the southern part of the country (Taufflieb, 1962; Bergmans, 1979; Dowsett et al., 1991; Happold & Happold, 2013), this species was rarely caught during our fieldwork. Three individuals (2 males and 1 female) were netted in May at the Ouesso secondary forest site and measured 650 mm wingspan with 85–89 mm on the forearm (Table 2). Forest massifs in the southern regions, consisting of several caves, are types of habitats where large colonies of *R. aegyptiacus*, numbering more than 2,500 individuals, have been located (Adam & Le Pont, 1974).

Genus *Megaloglossus* Pagenstecher, 1885
***Megaloglossus woermanni*** Pagenstecher, 1885

This very rare species was only represented by a single male captured in October in the secondary forest of Ouesso. With a wingspan of 310 mm and a mass of 15 g (Table 2), *Me. woermanni* is the smallest species of fruit bat in Africa (Monadjem et al., 2010). In the past, it had already been located in the Bangou forest massifs in the south of the country by Adam and Le Pont, 1974. Later, samples of this species from Mbamou Island and Dimonikade in the Mayombe were brought back by Bergmans (1979).

Genus *Epomophorus* Bennett, 1836
***Epomophorus intermedius*** Hayman, 1963

A total of three specimens (2 females and 1 male) of this very rare little fruit bat (Fig. 3) were captured in September near the ficus trees at Impfondo harbour. One of the females, with a wingspan of 39 mm and a forearm length of 53 mm, was preg-

nant with a developing foetus. This species which was newly recorded in the country during the course of this study, differs morphologically from *E. pusillus*, already recorded in Congo, in the appearance of the palatal folds (Happold & Happold, 2013). Endemic to southern Africa, this species has only been recorded from four localities in northern Angola and southern Democratic Republic of Congo (Bergmans, 1989; Monadjem et al., 2010). With the exception of this new collection, no other specimens have been captured for over 50 years, and it would appear that the destruction of its habitat by deforestation is the cause of its decline (Bergmans, 1989; Mickleburgh et al., 2008).

| TAXA | OUESSO | | | | IMPFONDO | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | Site 1 Secondary forest | | Site 2 Gallery forest | | Site 3 Secondary forest | | Site 4 Urban areas | | |
| **PTEROPODIDAE** | n | Abundance | n | Abundance | n | Abundance | n | Abundance | N |
| ***Eidolon helvum*** | 152 | 60.8 | 84 | 63.15 | 92 | 65.24 | 24 | 55.81 | 352 |
| ***Hypsignathus monstrosus*** | 71 | 28.4 | 20 | 15.03 | 37 | 26.24 | 11 | 25.58 | 139 |
| ***Myonycteris torquata*** | 4 | 1.6 | 9 | 6.76 | 6 | 4.25 | 0 | 0 | 19 |
| ***Epomops franqueti*** | 4 | 1.6 | 16 | 12.03 | 2 | 1.41 | 0 | 0 | 22 |
| ***Epomophorus intermedus**** | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 6.97 | 3 |
| ***Epomophorus gambianus**** | 1 | 0.4 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| ***Megaloglossus woermanni*** | 1 | 0.4 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| ***Rousettus aegyptiacus*** | 3 | 1.2 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| **HIPPOSIDERIDAE** | | | | | | | | | |
| ***Macronycteris gigas*** | 6 | 2.4 | 2 | 1.50 | 0 | 0 | 0 | 0 | 8 |
| **EMBALLONURIDAE** | | | | | | | | | |
| ***Saccolaimus peli**** | 5 | 2 | 1 | 0.75 | 2 | 1.41 | 0 | 0 | 8 |
| **MOLOSSIDAE** | | | | | | | | | |
| ***Mops condylurus*** | 3 | 1.2 | 1 | 0.75 | 2 | 1.41 | 5 | 11.62 | 11 |
| **TOTAL SPECIMENS** | **250** | | **133** | | **141** | | **43** | | **567** |
| **NUMBER OF SPECIES** | **10** | | **7** | | **6** | | **4** | | **11** |

Table 1. List of species collected, number of specimens per site and species dominance (between March 2021 and September 2023). *First record in Congo Republic.

***Epomophorus gambianus*** Ogilby, 1835

A single adult female weighing 122 g (Fig. 4), with a wingspan of 670 mm and a forearm length of 92.3 mm (Table 2), was collected at site 1 (secondary forest) in Ouesso in May. Four species belonging to the genus *Epomophorus* had already been recorded in the Republic of Congo (Malbrant & Maclatchy, 1949; Bergmans, 1979). Although reported from other countries in the African sub-region (Bergmans, 1988; ACR, 2024), the recent location of this species in the north of the country shows that it is distributed throughout the forests of the Congo Basin.

Familia EMBALLONURIDAE Gervais, 1856

Genus *Saccolaimus* Temminck, 1838
***Saccolaimus peli*** Temminck, 1853

The capture of 8 specimens, including 2 females, of this large insectivorous bat in secondary forest sites in Ouesso and Impfondo, indicates its first location in Congo Republic. With a dark brown to blackish coat (Fig. 5), it has already been reported in the forests of three Central African countries, namely Cameroon, the Democratic Republic of Congo and the Central African Republic (ACR, 2024).

Familia HIPPOSIDERIDAE Lyddeker, 1891

Genus *Macronycteris* Gray, 1866
***Macronycteris gigas*** Wagner, 1845.

For this species, a total of eight specimens, comprising five females and three males, were captured exclusively at the two Ouesso sites, with the majority (6 specimens) at the secondary forest site (Table 1). On the basis of biometric measurements, this

| Species | Sex | Body weight | Forearm | Wingspan | Ear | Tibia | Tail |
|---|---|---|---|---|---|---|---|
| | | min–max | min–max | min–max | min–max | min–max | min–max |
| ***Eidolon helvum*** | male (n = 155) | 100–320 | 95–126 | 750–880 | 25–31 | Nd | Very short |
| | female (n = 197) | 104–335 | 95–131 | 750–900 | 25–31 | Nd | Very short |
| ***Hypsignathus monstrosus*** | male (n = 65) | 142–455 | 95–140 | 730–990 | 28–35 | Nd | absent |
| | female (n = 73) | 102–300 | 95–130 | 710–940 | 28–35 | Nd | absent |
| ***Myonycteris torquata*** | male (n = 7) | 24–40 | 55–60 | 390–450 | 16–19 | 19.7–23 | Very short |
| | female (n = 12) | 20–41 | 53–61 | 370–450 | 15–19 | 20–22 | Very short |
| ***Epomops franqueti*** | male (n = 13) | 50–252 | 75–98 | 550–720 | 22–28 | 29–41 | absent |
| | female (n = 9) | 50–135 | 75–96 | 550–690 | 22–27 | 21–39 | absent |
| ***Epomophorus intermedius*** | male (n = 1) | 24 | 50.2 | 370 | 16 | 21.1 | absent |
| | female (n = 2) | 21–32 | 49–53 | 360–390 | 14–16 | 20–22 | absent |
| ***Epomophorus gambianus*** | female (n = 1) | 122 | 92.3 | 670 | 25 | 34.1 | absent |
| ***Megaloglossus woermanni*** | male (n = 1) | 15 | 44.1 | 310 | 13 | 16,7 | Very short |
| ***Roussettus aegyptiacus*** | male (n = 2) | 93–100 | 85–89 | 620–650 | 20 | 39–42 | Very short |
| | female (n = 1) | 85 | 86 | 650 | 20 | 40 | Very short |
| ***Macronycteris gigas*** | male (n = 3) | 95–103 | 100–107 | 648–650 | 30–33 | 43–45 | 26–32 |
| | female (n = 5) | 105–120 | 106–107 | 640–650 | 29–31 | 42–45 | 30–34 |
| ***Saccolaimus peli*** | male (n = 6) | 82–93 | 85–93 | 630–650 | 20–25 | 37–38 | 23–35 |
| | female (n = 2) | 68–70 | 93–95 | 570–630 | 22–23 | 38–39 | 25–26 |
| ***Mops condylurus*** | male (n = 4) | 22–23 | 46–48 | 350–360 | 16–17 | 13–15 | 40–41 |
| | female (n = 7) | 23–27 | 45–47 | 350–360 | 16–17 | 12–17 | 40–41 |

Table 2. Measurements of the various physical parameters of the species caught in the two study areas.
Nd : No determined. All measurements are in mm, except weight(g)


Figures 3, 4. Fruit-bats species newly recorded during this study. Fig. 3: *Epomophorus intermedius*. Fig. 4: *Epomophorus gambianus.* Figure 5. *Saccolaimus peli* collected in Ouesso.

species represents the largest insectivorous bat found in these forest habitats (Table 2). Its distribution extends from West Africa to the Congo Basin (ACR, 2024).

Familia MOLOSSIDAE Gervais, 1856

Genus *Mops* Lesson, 1842
***Mops condylurus*** (A. Smith, 1833)

This little bat was the most abundant of the insectivorous species collected during our fieldwork. It consisted of 7 females and 4 males, captured in both types of forest habitat (secondary forests and galleries) and in an urban environment. It has long been known in the Congo chiropteran community (Malbrant & Maclatchy, 1949) and is found throughout the sub-Sahelian region of the African continent (ACR, 2024).

## CONCLUSIONS

This study highlights the specific composition of the bat community in forest habitats on the outskirts of Ouesso and Impfondo. It revealed the presence of eleven species of bat, eight of which are frugivores. *Eidolon helvum* was the most abundant Pteropodidae species observed, followed by *Mops condylurus* among the insectivorous species. Two species common to African tropical forests, *Epomophorus gambianus* and *Saccolaimus peli*, and another highly endemic species, *Epomophorus intermedius*, were newly recorded, bringing the total number of species recorded in the Republic of Congo to date to 46.

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