

# Biodiversity and ecology of small mammals (Rodents and Shrews) of the “Réserve de Faune à Okapis”, Democratic Republic of the Congo

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**ABSTRACT.** We carried out a small mammal (rodents and shrews) inventory in the Okapi Fauna Reserve in the Ituri Forest, Democratic Republic of Congo. Using snap traps and life traps we collected 1577 specimens of small mammals belonging to 7 species of Soricomorpha and 23 species of Rodentia. Rodents included *Hylomyscus parvus*, which previously only was known in D.R.Congo near Kisangani. The record of *Crocidura congobelgica* (Soricomorpha) is the second record after the description of the species.

*Hybomys cf. lunaris* (27.58%) and *Praomys jacksoni* (21.81%) were the most abundant and ubiquitous species on the prospected habitats (mixed forest, monodominant forest, swampy forest, hill forest, secondary forest and fallows) except in grassy fallows where *Lophuromys dudui* was the most abundant species. Other common species in the Reserve included *Deomys ferrugineus*, *Hylomyscus stella*, *H. aeta*, *Malacomys longipes* and *Praomys misonnei*. Shrews included *Crocidura congobelgica*, *C. hildegardeae*, *C. olivieri* and *Scutisorex somereni*. The Shannon-Wiener and Simpson diversity indices show a large diversity and high equitability in small mammal communities. The sex ratio for the principal species was near parity. All the species seemed to breed throughout the year but for most reproduction was less intensive in the dry season.

**KEY WORDS :** rodents, shrews, biodiversity, ecology, R.D. Congo, Réserve de Faune à Okapi.

## INTRODUCTION

The biodiversity of the rainforest of Congo remains poorly documented. This is particularly true for small mammals. We carried out a study on small mammals (rodents and shrews) in the Réserve de Faune à Okapis, which is situated in the Ituri Forest, in the Northeast of the Democratic Republic of Congo. The Ituri forest ( $\pm 70000$  km<sup>2</sup>) and Epulu locality are well known as the main habitat of Okapi, *Okapia johnstoni* (Sclater, 1901). This forest also is the habitat of a diversity of other mammals, and one of the world's greatest diversity hotspots for forest ungulates (HART, 1985). The protection of the okapi's natural habitat led in 1992 to the establishment of a Natural Reserve named “Réserve de Faune à Okapis” here “RFO” (Fig. 1).

Since the middle of the 1980's, studies were undertaken in this forest in order to document the biodiversity as a basis for management (HART, 1985; HART, 1985; SIKUBWABO, 1987; KATEMBO, 1990; CONWAY, 1992; EWANGO, 1994; NDJANGO, 1994; TSHOMBE, 1994; MAKANA et al., 1998; MAKANA, 1999; HART & CARRICK, 1996; HART & BENGANA 1997). The present small mammal survey was carried out in July-August 1993 and March 1994.

## Study areas

The RFO (13500 km<sup>2</sup>) stretches from 1° to 3° N and 28° to more than 29° E. The elevation varies between 700 m a.s.l. in the extreme west and 1350 m on the highest rocky hills between the Epulu-Nepoko Rivers (HART & BENGANA, 1997).

Vegetation can roughly be classified as a mosaic of tropical rain forests including primary forest, swamps or marsh forests, fallows and secondary forests. Primary forests are mixed forests dominated by *Julbernardia seretii* and *Cynometra alexandri* (Caesalpiniaceae) and monodominant forests dominated by *Gilbertiodendron dewevrei* (Caesalpiniaceae). Descriptions of these forests can be found in HART (1985), EWANGO (1994), NDJANGO (1994), MAKANA et al., (1995) and MAKANA (1999). There are no detailed climatic records for the RFO as a whole. However, BURTOT (1971) estimated the mean annual temperature as about 24 °C and annual rainfall between 1700 and 1800 mm. April, May, August and September are wettest while December, January and February receive less than 100 mm of precipitation. HART & CARRICK (1996) confirmed this climatic tendency in the research stations of Afarama, Epulu and Lenda (Fig. 2).

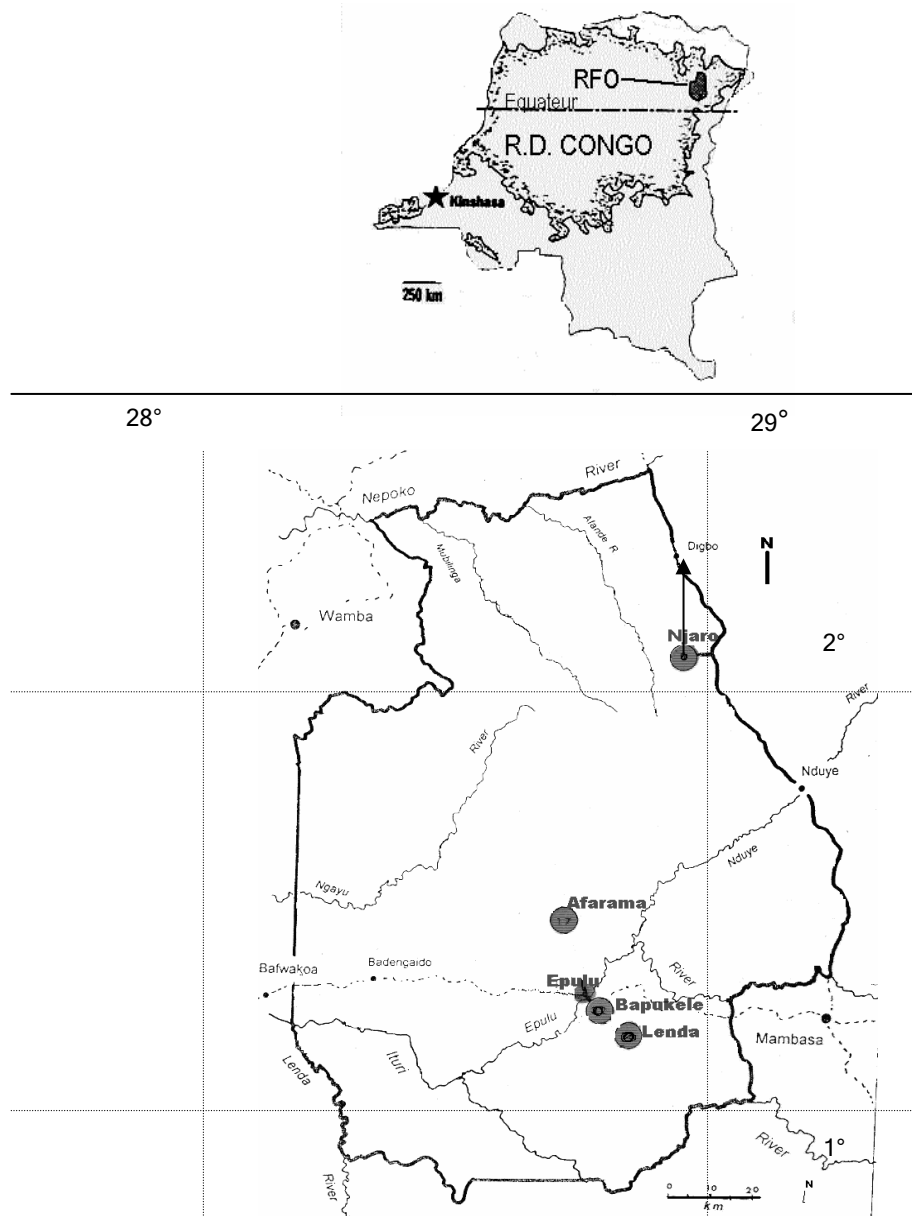


Fig. 1. – Map of the Réserve de Faune à Okapis, D.R.Congo, showing prospected localities (adapted from HART & BENGANA, 1997).

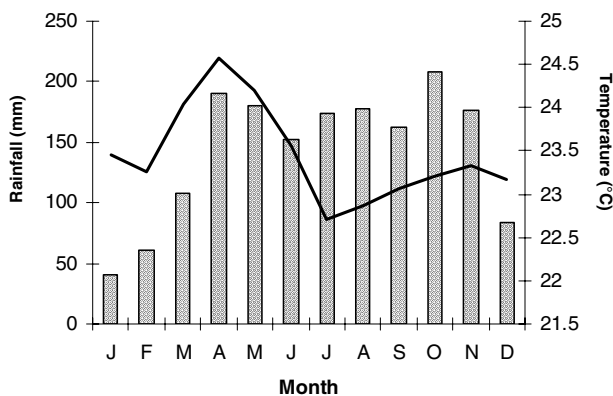


Fig. 2. – Annual variation of rainfall and temperature in RFO : Epulu sector (after data from HART & CARRICK, 1996).

## MATERIAL AND METHODS

Small mammals were collected during two periods : 28 June to 8 August 1993 and 2 to 28 March 1994 in five localities : Afarama (AF) 1° 33' N, 28° 31' E, 800 m a.s.l.; Bapukele (BA) Epulu (EP) 1° 24' N, 28° 35' E, 760 m, Lenda (LE) 1° 19' N, 28° 38' E, 750 m and Njaro (NJ) 2° 03' N, 28° 50' E 960 m with Aketu hill 2° 5' N 28° 48' E, 1200 m.

Trap lines with trapping stations approximately 10 m apart were set following paths, trails, streams or small rivers. Three types of traps were used : Sherman LFA live traps, and “Victor” snap traps and “Museum Special” snap traps. Two traps baited with the pulp of palm nut (*Elaeis guinensis*) were placed at each trap station for tree consecutive nights. Traps were checked in the morning from 8 :30 am, and sometimes once again toward 5 :00 pm.

Each captured small mammal was preliminary identified, sexed, weighed and measured externally, sacrificed and then fixed in 10% formaldehyde solution. Identification and collection of reproductive condition data were completed in the laboratory. Diversity was evaluated with the Shannon-Wiener index, Simpson index and Equitability index. Local diversity indices were compared between localities using the sectoral index  $H_p$  (see KREBS, 1994; RAMADE, 1984).

## RESULTS AND DISCUSSION

### Species composition

We collected 1577 small mammals belonging to 30 species. The collection includes 33 shrews (2.09%, 7 species) and 1544 rodents (97.91%, 23 species). Seven shrew species were caught. The most common species are *Crocidura denti* (0.57%) and *C. olivieri* (0.44%). The record of *C. congobelgica* is the second record after the description of the species in 1916 (HOLLISTER, 1916). Shrew diversity in RFO seems to be poorer than in Masako Reserve (12 species) (DUDU, 1991). This might be due to the short survey period of our study and the use of Victor and Museum Special snap traps that are not very appropriate to catch shrews.

Among the rodents four groups occur. Dominant species *Hybomys cf. lunaris* (27.58%), *Praomys jacksoni* (21.81%) and *Hylomyscus stella* (13.25%) represent

together 62.65% of all rodent specimens. Moderately abundant species *Praomys misonnei* (6.53%), *Malacomys longipes* (5.96%) *Hylomyscus aeta* (5.77%), *Deomys ferrugineus* (5.07%) and *Lophuromys dudui* (4.57%) total 27.90%. Occasional species *Mus minutoides* and *Lophuromys luteogaster* with respectively 2.28% and 1.84%. The last group includes twenty rare species (<1% each) that together total only 5.33% of all specimens. Among the rare species we found *Hylomyscus parvus*, which grants RFO the status of being the second site in D.R. Congo where *H. parvus* is recorded, the first site being Masako near Kisangani. Other noteworthy rare species are *Dendromus mystacalis*, *Graphiurus lorraineus*, *Colomys goslingi* and *Praomys verschureni*. With 23 species recorded, the rodent species diversity in RFO seems to be high and comparable to of the other forest blocks in the Congo-basin. RAHM (1966) and DUDU (1991) mentioned 26 and 28 species respectively for Irangi and Masako. Around Kisangani, new data (MUKINZI et al., 2003) counted 30 species. The number of species in the RFO, reported here, is only a minimum value and could increase by surveys that are extended time and space, by including species that we have seen but not caught, as well as species reported by other authors as HATT (1940) and CARPANETO & GERMI, (1989). These species are *Thryomys swinderianus*, *Atherurus africanus*, *Anomaluropus beecrofti*, *Anomalurus derbianus*, *A. pusillus*, *Idiurus macrotis* and *I. zenkeri*; *Funisciurus pyrrhopus*, *F. alexandri*, *Heliosciurus rufobrachiu*, and *Protoxerus stangeri*.

TABLE 1

Number of specimens collected for different species in the Réserve de Faune à Okapis, DR Congo, in 1993 and 1994. The lower part of the table indicates a number of diversity indices.

Species	1993	1994	Total
<b>Soricomorpha</b>			
<i>Crocidura congobelgica</i> Hollister, 1916	3	1	4
<i>Crocidura denti</i> Dollman, 1915	3	6	9
<i>Crocidura hildegardeae</i> Thomas, 1904	-	3	3
<i>Crocidura latona</i> Hollister, 1918	1	2	3
<i>Crocidura olivieri</i> (Lesson, 1827)	4	3	7
<i>Crocidura</i> sp.	2	2	-
<i>Scutisorex somereni</i> (Thomas, 1910)	2	2	4
<b>Rodentia</b>			
<i>Colomys goslingi</i> Thomas & Wroughton, 1907	-	2	2
<i>Cricetomys emini</i> Wroughton, 1910	-	1	1
<i>Dendromus mystacalis</i> Heuglin, 1863	-	1	1
<i>Deomys ferrugineus</i> Thomas, 1888	44	36	80
<i>Funisciurus anerythrus</i> (Thomas, 1890)	2	1	3
<i>Grammomys kuru</i>	1	2	3
<i>Graphiurus lorraineus</i> Dollman, 1910	1	-	1
<i>Hybomys cf. lunaris</i> Thomas, 1906	173	262	435
<i>Hylomyscus aeta</i> (Thomas, 1911)	75	16	91
<i>Hylomyscus parvus</i> Brosset et al., 1965	-	1	1
<i>Hylomyscus stella</i> (Thomas, 1911)	88	121	209
<i>Lemniscomys striatus</i> (Linnaeus, 1758)	2	6	8
<i>Lophuromys dudui</i> Verheyen et al., 2002	39	33	7
<i>Lophuromys luteogaster</i> Hatt, 1934	4	25	29
<i>Malacomys longipes</i> Milne-Edwards, 1877	46	48	94
<i>Mus minutoides</i> A. Smith, 1834	5	31	36
<i>Oenomys hypoxanthus</i> (Pucheran, 1855)	1	9	10
<i>Paraxerus boehmi</i> (Reichenow, 1886)	1	5	6
<i>Praomys jacksoni</i> (De Winton, 1897)	118	226	344
<i>Praomys misonnei</i> Van der Straeten & Dieterlen, 1987	57	46	103
<i>Praomys verschureni</i> (Verheyen & Van der Straeten, 1977)	1	2	3
<i>Rattus rattus</i> (Linnaeus, 1758)	-	3	3
<i>Stochomys longicaudatus</i> (Thomas, 1915)	6	4	10
Number of specimens	677	900	1577
Number of species	23	29	30
Shannon-Weiner diversity index $H_a$	3.161	3.121	3.205

TABLE 1

Number of specimens collected for different species in the Réserve de Faune à Okapis, DR Congo, in 1993 and 1994. The lower part of the table indicates a number of diversity indices.

Species	1993	1994	Total
$H_{\alpha}$ maximum (Hmax)	4.523	4.858	4.907
Equitability (E)	0.698	0.643	0.653
Simpson diversity index (D)	0.855	0.823	0.800
Sectoral index $H_{\beta}$			0.063

A lower number of species was recorded in at Afarama (11) and Lenda (12) where undisturbed primary forests prevail than in Bapukele (16), Epulu (22) and Njaro (24) where the regenerating habitats (fallows and secondary forest) are common. Indeed, in these anthropogenous environments, crops and rich herbaceous stratum provide small mammals with food and necessary shelter as suggested by DIETERLEN (1989) and DUDU (1991).

The community of small mammals in the localities of the RFO is much diversified :  $H_{\alpha}$  = 2.766; 2.779; 3.018; 3.054; 3.156; and D = 0.843; 0.825; 0.799; 0.818; and 0.838 and E = 0.800; 0.775; 0.684; 0.671; and 0.789 respectively for Afarama, Lenda, Epulu, Njaro, and Bapukele. The same species are encountered in different localities and habitats as shown by the Shannon-Wiener sectoral index ( $H_{\beta}$ ). In all pairs of localities,  $H_{\beta}$  approaches zero, indicating very strong similarity between the localities (RAMADE, 1984) (the lowest value was 0.026 for Bapukele-Epulu and the highest value 0.233 for Afarama-Epulu) (Fig. 3).

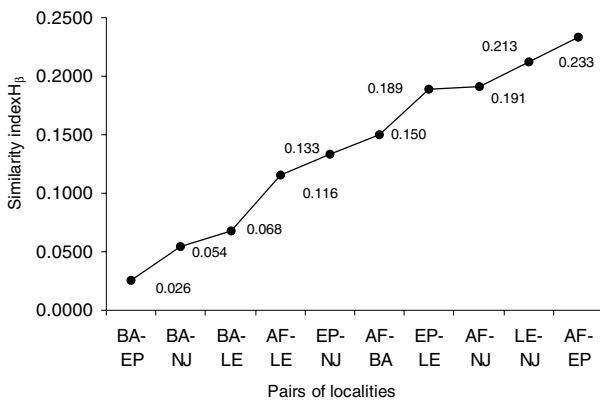


Fig. 3. – Pairwise similarity between trapping localities in the Réserve de Faune à Okapis, D.R.Congo

**Sex ratio**

The sex ratio (males/females) of 13 main species was not far from parity (Table 2). However, in most species a slight advantage in favour of males was observed. Our results are similar to those obtained by DUDU (1991) and DUDU et al. (1997) in Masako Reserve.

**Reproduction**

Reproduction occurred in both trapping periods (seasons) although it seems more intensive in the wet season. All three age classes (juveniles, sub-adults and adults) were present in the wet and dry seasons. The percentage of pregnant females varied between 25 and 62%. In the

TABLE 2

Sex ratio of the most common species Réserve de Faune à Okapis (RFO, this study) and Masako Reserve (DUDU, 1991)

Species	RFO		Masako	
	F	M	M/F	M/F
<i>Deomys ferrugineus</i>	33	41	0.80	0.67
<i>Hybomys cf. lunaris</i>	196	231	0.85	0.98
<i>Hylomyscus aeta</i>	50	41	1.22	-
<i>Hylomyscus stella</i>	81	122	0.66	0.47
<i>Lophuromys dudui</i>	34	38	0.89	0.85
<i>Lophuromys luteogaster</i>	13	11	1.18	-
<i>Malacomys longipes</i>	46	47	0.98	1.15
<i>Mus minutoides</i>	12	11	1.09	-
<i>Oenomys hypoxanthus</i>	5	3	1.67	-
<i>Paraxerus boehmi</i>	1	5	0.20	-
<i>Praomys jacksoni</i>	143	186	0.77	0.70
<i>Praomys misonnei</i>	38	64	0.59	-
<i>Stochomys longicaudatus</i>	5	5	1.00	1.08

wet season, there were 28 to 81% pregnant females, whereas in dry season this percentage declined slightly (23 to 55%) according to the species (Fig. 4).

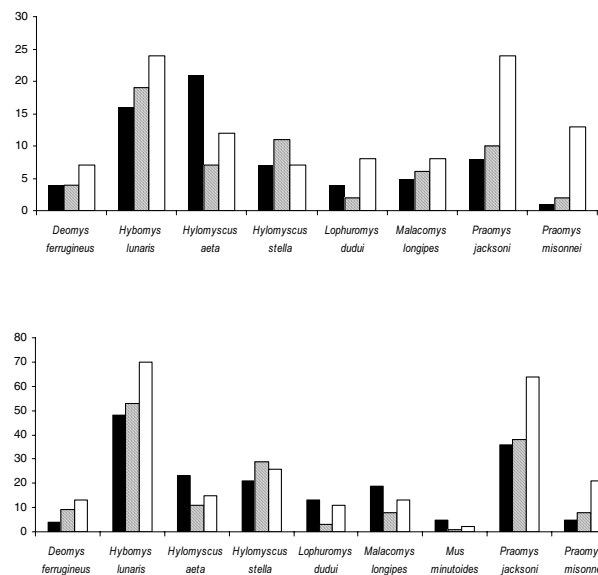


Fig. 4. – Proportion of female reproductive classes in common species during the wet season (upper graph) and the dry season (lower graph) in the Réserve de Faune à Okapis, D.R.Congo. Black columns = juveniles, barred columns = adults, white columns = pregnant.

The presence of sexually active individuals in each trapping session is an indication of reproductive activity

during the wet and the dry season. Several authors reported that the reproduction activity of small mammals in the tropical rain forest is continuous throughout the year, but with peaks in the wet season and troughs in dry season (RAHM, 1970; DUBOST, 1968; DIETERLEN, 1986; DUPLANTIER, 1989; DUDU, 1991). In the RFO, food resources are always available during the course of the year (HART, 1985) and breeding activity can take place in all seasons, but is still linked to the seasonal rainfall distribution (Fig. 2). This resembles the observations of DUBOST (1968) in Gabon, HAPPOLD (1977, 1978) in the Nigeria rain forest, and DUDU (1991) in Masako Reserve (RD Congo).

### Litter size

The litter size (Table 3) is generally small (1-4 embryos) with the average that varies in the same range as reported by RAHM (1970) HAPPOLD (1978) DIETERLEN (1989) and DUDU (1991) for the same species.

TABLE 3

Observed litter sizes of some common rodent species in the Réserve de Faune à Okapis, D.R. Congo. N=sample size; Max=maximum observed litter size; Avg=average observed litter size; Literature=reported values for this species in literature

Species	N	Max	Avg	Literature
<i>Deomys ferrugineus</i>	12	3	1.84	1.69
<i>Hybomys cf. lunaris</i>	74	4	2.24	2.02-2.8
<i>Hylomyscus aeta</i>	14	4	3.14	2.9-3.4
<i>Hylomyscus stella</i>	25	4	3.00	-
<i>Lophuromys dudui</i>	11	3	2.50	1.83-3.0
<i>Malacomys longipes</i>	13	4	2.30	2.5-3.19
<i>Praomys jacksoni</i>	65	4	3.06	2.19-3.8
<i>Praomys misonnei</i>	20	4	3.15	-

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