Bushmeat trade in Kisangani (DRC), Constancy and Abundance of Mammalian Species on the Market from 1976 to 2016

Commercialisation de la viande de brousse à Kisangani (RDC), constance et abondance des espèces mammaliennes sur le marché de 1976 à 2016

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Abstract—Bushmeat is regularly sold and be consumed in Kisangani. The copulated data show not only very high occurrences but also species composition changes year after year, few of them remain constant in the market. This implies that monitoring activities must be developed in this sector. Kisangani region is experiencing an erosion of its biodiversity due to the bushmeat trade. A significant proportion of the specimens of meat marketed is protected species near 8.44%. Colobuses, water snakes and elephants are the most commercially protected species on the market for commercialized game. The analysis of data copulated over the period from 1976 to 2016 reveals an estimated occurrence of 118090 specimens sold whose constant species frequencies higher than 50%, are listed as follows: Primates include Cercopithecus ascanius, Cercopithecus hamlyni, Cercopithecus hoesti, Cercopithecus mitis, Cercopithecus neglectus, Cercopithecus mona, Colobus angolensis, Lophocebus albigena, Papio anubis and Piliocolobus badius. For Artiodactyla, Philantomba monticola, Cephalophus dorsalis, Cephalophus nigrifrons, Cephalophus sylvicultor, Hyemoscus aquaticus, Tragelaphus spekei, Potamochoerus porcus. For Rodents, it concerns Atherurus africanus, Cricetomys emini. The remaining species are either incidental or accidental.

From the relative abundance point of view in Primates, Cercopithecus ascanius 26.73%, Cercopithecus mitis 6.68%, Cercopithecus hoesti 6.3%, Colobus angolensis 4.3%, Procolobus badius 6%.

In the Artiodactyla, Philantomba monticola predominates with 54.4%, Cephalophus dorsalis 11.7%, 5.06%, Cephalophus nigrifrons 5.99%.

For Rodents, Cricetomys emini predominates with 57.59%, Atherurus africanus 21.44%, Cricetomys gambianus 20.48%

Others animals groups trade are giant pangolin Smutsia gigantea 90.13%, Dendrohyrax dorsalis 64.88%, Orycteropus afer 37.5%, Osbornictis piscivora 73.21%, Bdeogale nigripes 26.62%, and finally Eidolon helvum for Bats 76.9%.

Keywords—Bushmeat trade, species constancy, species abundance, status of exploited species, Kisangani.

Résumé—La viande de brousse est régulièrement vendue et consommée à Kisangani. Les données copulées montrent non seulement des occurrences très élevées mais aussi la composition des espèces change d’année en année, peu d’entre elles restent constantes sur le marché. Ce qui implique que des activités de surveillance doivent être développées dans ce secteur. La région de Kisangani connait une érosion de sa biodiversité due au commerce de la viande de brousse. Une proportion non négligeable des spécimens commercialisés est constituée d’espèces protégées soit 8.44%. Les Colobes, les chevrotains aquatiques et les éléphants sont les espèces protégées les plus inventoriedes au marché parmi le gibier commercialisé.
I. INTRODUCTION

The diversity and the biological wealth of the DRC are not to be demonstrated nowadays. Indeed, the geo climatic position of the Congo confers on him various advantages among others a great potentiality in wild fauna starting with the smallest animals until large mammals. The DRC has the privilege of counting on its territory magnificent national parks, hunting grounds and a large number of forest reserves allowing a big industry starting from the wild life, industry which would intervene positively in the economy of the country if we became aware of it.

The major problem or challenge for this beautiful and large country is rational and sustainable exploitation of resources. The daily survival of many forest households is highly dependent on natural resources (Delvingt 2001, De Merode et al., 2011, Valimahamed, 2014, Consolate et al., 2016, 2017 and 2018, Musaba, 2018). Concerning the exploitation of game animals, the review of the existing literature shows the existence of a serious problem of management of wild herds. Hunting as practiced in the Kisangani region is far from rational, thus causing wildlife erosion (Feer 1996, Kabongo 2005, Van Vliet et al., 2012).

Examination of different aspects of the hunting activity of the region states, it does not operate in accordance with ecological principles relating to animal production and the exploitation of ecosystems. It does not also obey the standards of the existing regulations. The pace and the manner in which the current samples are taken do not guarantee durability. Since we must act upstream and downstream to save the situation, all stakeholders must change their way of doing and living: consumers, traders, managers; hunters in particular must behave as cautious and intelligent predators. They must know how to limit, select their samples while maintaining the diversity and structure of animal populations that condition the balance of ecosystems.

Two fundamental questions were asked:
What is the constancy and abundance of the regularly sold species in the different urban and rural markets of the city of Kisangani from 1976 to 2016?
Secondly, taking into account the law on hunting in the country, what is the proportion of protected species in game markets in Kisangani?

II. BACKGROUND AND RATIONALE FOR THE STUDY

Like other regions of the Congo Basin, the exploitation of forest resources is a major activity in the Kisangani region. Bushmeat marketing and consumption studies began in 1976. On-site realities changed because of population growth, deforestation, and disturbance of wildlife habitat in a variety of ways (Delvingt 2001, De Merode, 1998, 2004, Mbete et al., 2011, Van Vliet and Mbazza, 2011, Valimahamed, 2014, Consolate et al., 2017 and 2018, Musaba, 2018). This study assess the regularity of the species on the market in the face of the growing demand for meaty foods as well as the increasing hunting pressure in the country.

Globally, the study aims to gather data on bushmeat harvesting in the Kisangani Forest Region from 1976 to 2016 to monitor and report on the status of this resource, which is highly valued by urban-rural populations. New approaches to monitoring biodiversity require the development of monitoring indicators that can be evaluated year-by-year in order to identify likely changes. Specifically, the study analyzes the evolution of the

Mots clés — Ressources naturelles, commerce, viande de brousse, constance, abondance, statut des espèces, Kisangani.
market through a few indicators such as the regularity of species on the market, their abundance and their status.

**Brief description of the study environment**

The present Province of Tshopo resulting from the dismemberment of the Province Orientale is an entity which covers an area of 199,567 km², with a population estimated at approximately 2,614,630 inhabitants and a density of 9 inhabitants per km² (Nebesse, 2016). It is crossed in the middle by the equator; it goes from -2 ° South latitude to +2 ° North latitude, about 400 km and 22 ° to 28 ° East longitude, about 600 km. Characterized by a warm and humid climate to which the dense equatorial forest corresponds, the hydrographic network is entirely of fresh water.

Wildlife is dependent on the environment in which it evolves. For her, vegetation is one of the most important environmental factors. It serves as habitat but is also a source of food. Dajoz (1982) states that with regard to dietary factors, vegetation plays a major role in the life of animals. For the quality, quantity and accessibility of the food it provides, it influences various parameters of wildlife populations such as fertility, longevity, speed of development, birth rate. The diversification of the diets, says the author, is at the origin of many morphological, physiological and ecological adaptations which are the witnesses of a long coevolution between the herbivores and the plants, between the predators and their preys (Dajoz, 1982).

The province of Tshopo is located in the middle of the Congolese central basin characterized by the hot and humid equatorial climate. It is an area of dense forests. Primary forests and secondary plant formations are distinguished.

There are three types of primitive plant formations:

a) evergreen rainforests, two types: the forest with *Brachystegia laurentii* Germain (1960) is found on Lubutu, Opala and Yangambi roads. This exuberant formation is very widely represented in the region; and with *Gilbertiodendron dewevrei*.

b) Guinean semi-deciduous forest mesophiles forests. They are climax forests characterized from the physiognomic point of view by a mixture of evergreen and deciduous species. Despite their heterogeneous nature, Lubini (1982) recognized two types: the forest dominated by *Scrophlophoefulzenkeri* and the predominantly *Celtis* forest of various species.

c) There are three types of edaphic forests linked to hydromorphic soils: riparian groups, riparian forests and swamp forests (Lubini, 1982).

The detailed study of the messicultural, segural and postcultural vegetation of the Tshopo administrative sub-regions was made by Lubini (1982). The author distinguishes four types of vegetations: adventitious vegetation of annual or perennial crops:

- Vegetation of grassy fallows
- Vegetation of fallow land and forest regrowth
- Secondary forest vegetation

In addition, protected areas and forest areas are remarkable habitats for wildlife (Mbete *et al.*, 2011). In this forest region, there are few breeding alternatives for the supply of animal protein, and hunting meat is an important source of protein in the diet of the people of the Congo Basin (Willcox and Nambu, 2007; Kumpel *et al.*, 2010). In fact, the populations of the Congo Basin have always practiced a customary hunting of self-subsistence. It occupies an important place in the economic and cultural organization of these forest companies (Agnagna 2001, Delvingt 2001).

**III. METHODS**

To achieve the objectives assigned to the study, the following steps were taken: the exploitation of research results available in libraries and on the internet about bushmeat in the Kisangani forest region (published articles, doctoral theses, DEA, Masters dissertations, non governmental organisation reports, field and laboratory notebooks). Relevant information and data on bushmeat available from 1976 to 2016 have been copied and processed through Excell 2016. Relative abundance (AR) per wildlife species sold is estimated by the formula

\[ AR(\%) = \frac{\sum P}{\sum P} \times 100 \]

Where pi indicates the number of times a species appears on the market in the year.

P: total number of appearances%

\%: Percentage

- If C is in the range [50, 100], then the species is constant;
- If C > 50%, C is in the range [25, 50], then the species is accidental;
- If C < 25%, C is in the range [0.25, 100], then the species is accidental.

For all groups, the constancy was calculated taking into account eight columns (data) although for some there is no data.

**IV. RESULTS**

The following tables show the category of wildlife marketed in Kisangani, the authors who focused on the exploitation of game in Kisangani, from 1976 to 2016, and the annual inventoried specimens. We calculated the relative abundance (R.A) by species but also assessed the regularity of the species thanks to the copulated surveys.
A total of 25385 occurrences recorded over 8 years of study for which data are available. The first observation is that we note a large majority of primate trade. 29.3% of them are not well identified due to the mode of conservation of the specimens. Smoking of specimens destroys essential hairs for species identification. Among

| Species                        | Banamuhere | Wes | Biya | Gombe-Moko | Bembo | Salamat | Nebese | Nebese | Kasvura | Total | RA (%) | Constancy (%) | Status |
|--------------------------------|------------|-----|------|------------|-------|---------|--------|--------|---------|-------|--------|---------------|--------|
| Cercopithecus ascanius          | 154        | 715 | 915  | 467        | 204   | 845     | 284    | 2073   | 1129    | 6786  | 26.73  | 100            | NP     |
| Cercopithecus hamlyni           | 8          | 14  | 16   | 45         | 38    | 0       | 2      | 15     | 618     | 756   | 2.97   | 87.5           | NP     |
| Cercopithecus thoei             | 6          | 84  | 72   | 103        | 71    | 5       | 56     | 930    | 297     | 1624  | 6.39   | 100            | NP     |
| Cercopithecus mitis woffi       | 41         | 221 | 242  | 232        | 69    | 372     | 104    | 61     | 355     | 1697  | 6.68   | 100            | NP     |
| Cercopithecus neglectus         | 1          | 13  | 0    | 34         | 4     | 0       | 1      | 0      | 171     | 224   | 0.88   | 75             | NP     |
| Cercopithecus nikitans          | 0          | 0   | 0    | 0          | 0     | 0       | 0      | 9      | 444     | 453   | 1.78   | 12.5           | NP     |
| Cercopithecus mondenti          | 49         | 128 | 180  | 88         | 6     | 0       | 2      | 2      | 0       | 455   | 1.79   | 87.5           | NP     |
| Cercopithecus wolfi             | 0          | 0   | 0    | 0          | 0     | 15      | 0      | 0      | 15      | 0.059 | 12.5   |               | NP     |
| Cercopithecus sp                | 25         | 0   | 0    | 0          | 360   | 0       | 338    | 1055   | 0       | 1778  | 7      | 50             | NP     |
| Colobus angolensis              | 0          | 11  | 81   | 0          | 0     | 14      | 0      | 165    | 840     | 1101  | 4.33   | 50             | PP     |
| Colobus sp                      | 0          | 13  | 35   | 0          | 111   | 0       | 0      | 0      | 0       | 159   | 0.62   | 17.5           | PP     |
| Lophocebus albigena             | 4          | 38  | 5    | 23         | 0     | 0       | 0      | 0      | 453     | 523   | 2.06   | 62.5           | NP     |
| Pan paniscus                    | 0          | 0   | 0    | 0          | 0     | 3       | 0      | 3      | 0       | 3     | 0.01   | 12.5           | TP     |
| Pan troglodytes                 | 0          | 0   | 0    | 0          | 65    | 22      | 0      | 209    | 168     | 464   | 1.82   | 17.5           | TP     |
| Papio anubis                    | 9          | 18  | 0    | 2          | 15    | 9       | 22     | 21     | 260     | 356   | 1.4    | 87.5           | NP     |
| Gorilla gorilla                 | 0          | 0   | 0    | 0          | 0     | 1       | 0      | 0      | 0       | 1     | 0.003  | 12.5           | TP     |
| Piliocolobus badius             | 0          | 137 | 91   | 17         | 0     | 114     | 0      | 0      | 1108    | 1535  | 6.046  | 62.5           | PP     |
| Cercocebus galerita             | 0          | 0   | 1    | 0          | 0     | 0       | 0      | 0      | 1       | 0.004 | 12.5   |               | NP     |
| Other Primates non identify     | 442        | 1676| 3972 | 1004       | 360   | 0       | 0      | 0      | 0       | 7454  | 29.3   | 62.5           |        |
| Total per year                  | 739        | 3058| 5610 | 2015       | 1303  | 1382    | 824    | 4543   | 5843    | 25385 |        |               |        |

Table 1: Commercialization of Primates in Kisangani
fresh specimens identified, *Cercopithecus ascanius* predominates in relative abundance with 26.7%, followed by *Cercopithecus mitis Cercopithecus ascanius*, *Cercopithecus hamlyni*, *Cercopithecus hoesti*, *Cercopithecus mitis*, *Cercopithecus neglectus*, *Cercopithecus mona*, *Colobus angolensis*, *Lophocebus albigena*, *Papio anubis*, *Procolobus badius* 6.68%, *Cercopithecus the hoesti* 6.39% and *Procolobus badius* 6%. Blackcurrants, baboons, gorillas and bonobos are less abundant on the bushmeat market in Kisangani.

Table (1) shows 11 species of monkeys constant on the market with a coefficient greater than or equal to 50%. These are *Cercopithecus ascanius, Cercopithecus hamlyni, Cercopithecus hoesti, Cercopithecus mitis, Cercopithecus neglectus, Cercopithecus mona, Colobus angolensis, Lophocebus albigena, Papio anubis, Procolobus badius.* Other remaining monkey species listed in the table are classified as accidental with less than 25% constancy.

About the status of the species, 12.85% of the volume of monkey game sold is composed of protected species (3263 occurrences, including 2795 cases for partially protected species and 468 cases for totally protected species).

Table 2: Artiodactyla commercialization in Kisangani

| Species                          | Banamuhire | Wetsi | Biya | Gambalemoke | Belembo | Sakananu | Nebesse | Nebesse | Kaswera | Total | RA%   | Constancy (%) | Statut |
|----------------------------------|------------|-------|------|-------------|---------|----------|---------|---------|---------|-------|-------|----------------|--------|
| Cephalophus dorsalis (Gray, 1846) | 10         | 121   | 226  | 82          | 724     | 292      | 189     | 1546    | 1689    | 4879  | 11.7  | 100             | NP     |
| Philantomba monticola (Thanberg, 1789) | 2943     | 7937  | 5339 | 1280        | 1298    | 326      | 145     | 1636    | 1676    | 22580 | 54.4  | 100             | NP     |
| Cephalophus nigrifrons (Gray, 1871) | 15         | 13    | 10   | 6           | 861     | 141      | 45      | 688     | 709     | 2488  | 5.99  | 100             | NP     |
| Cephalophus sylvicultor (Afzelius, 1815) | 0         | 1     | 0    | 2           | 60      | 13       | 8       | 10      | 438     | 532   | 1.28  | 75              | PP     |
| Cephalophus callipygus (Peters, 1876) | 0         | 1     | 0    | 4           | 0       | 0        | 0       | 0       | 0       | 5     | 0.01  | 25              | NP     |
| Cephalophus kugocaster (J.E.Gray, 1873) | 0         | 0     | 0    | 2           | 0       | 0        | 0       | 0       | 1182    | 1184  | 2.85  | 25              | NP     |
| Cephalophus sp                     | 0         | 0     | 0    | 0           | 0       | 0        | 0       | 287     | 0       | 290   | 0.7   | 12.5             | NP     |
| Hyemoscus aquaticus (Ogilby, 1841) | 3         | 33    | 5    | 74          | 114     | 52       | 4       | 138     | 319     | 742   | 1.79  | 100             | TP     |
| Tragelaphus spekei (Sclater, 1864)  | 6         | 32    | 9    | 11          | 63      | 17       | 13      | 73      | 400     | 624   | 1.5   | 100             | PP     |
| Tragelaphus scriptus (Pallas, 1766) | 10        | 9     | 0    | 0           | 0       | 0        | 0       | 0       | 0       | 19    | 0.05  | 25              | PP     |
| Syncerus caffer (Sparman, 1779)    | 0         | 0     | 0    | 0           | 0       | 0        | 12      | 19      | 105     | 70    | 0.5   | 37.5             | PP     |
| Okapia johnstoni (P. L. Sclater, 1901) | 0         | 0     | 0    | 0           | 3       | 0        | 0       | 0       | 3       | 0     | 0.01  | 12.5             | TP     |
| Phacochoerus aethiopicus (Pallas, 1766) | 0         | 0     | 0    | 0           | 0       | 0        | 0       | 0       | 674     | 674   | 1.62  | 12.5             | PP     |
| Potamochoerus porcus (Linne, 1758)  | 16        | 23    | 60   | 13          | 103     | 80       | 70      | 595     | 1144    | 2104  | 5.06  | 100             | PP     |
| Suidae non identify               | 0         | 0     | 81   | 84          | 0       | 0        | 0       | 0       | 0       | 165   | 0.4   | 25              |        |
| **Artiodactyla non identify**     | **600**   | **1928** | **581** | **1942** | **0**  | **0**    | **0**  | **0**   | **0**   | **5051** | **12.2** | **50** |                   |
| Total                            | 3603       | 10098 | 6311 | 3500        | 3223    | 933      | 496     | 5078    | 8301    | 41543 |       |                 |        |
Table (2) shows 41543 occurrences recorded for Artiodactyls during the eight years of study. The most abundant species on the market in descending order are Philantomba monticola 54.4%, Cephalophus dorsalis 11.7%, and Cephalophus nigrifrons 5.99%. Unidentified specimens due to smoking mode of conservation account for 12.2% of the lot. Constant Artiodactyls species are Philantomba monticola, Cephalophus dorsalis, Cephalophus nigrifrons, Cephalophus sylvicultor, Hyemoscus aquaticus, Tragelaphus spekei, and Potamochoerus porcus. The accessories species with constancy between 49 and 25% are Cephalophus callipygus, leucogaster, Tragelaphus scriptus, Syncerus caffer, and unidentified specimens of Suidae. The remaining species listed in Table (2) are accidentals with less than 25% consistency. Artiodactyls protected species represent 11.8% of ungulates cargo sold during the study period. Totally protected species is about 754 occurrences and partially protected 4159 cases.

| Table 3: Rodent’s bushmeat trade in Kisangani |
|------------------------------------------------|
| **Species** | Banamhiere | Wetsi | Biya | Gambalemoke | Balambo | Sau-manu | Nebesse | Kaswena | Total | RA % | Constancy % | Statut |
| Atherurus africanus (Gray, 1842) | 139 | 489 | 538 | 0 | 637 | 570 | 71 | 2028 | 2466 | 6938 | 21.44 | 87.5 | NP |
| Cricetomys emini (Wroughton, 1910) | 2190 | 8797 | 5080 | 635 | 151 | 1653 | 122 | 0 | 0 | 18628 | 57.59 | 87.5 | NP |
| Cricetomys gambianus (Waterhouse, 1840) | 0 | 0 | 0 | 0 | 183 | 0 | 1761 | 4682 | 6626 | 20.48 | 25 | NP |
| Trionomys swinderianus (Fitzinger, 1867) | 0 | 0 | 0 | 0 | 0 | 10 | 39 | 105 | 154 | 0.47 | 25 | NP |
| Total | 2329 | 9286 | 5618 | 635 | 788 | 2406 | 203 | 3828 | 7253 | 32346 |

The copulation of market investigation data stipulates 32,346 cases of rodents sold. *Cricetomys emini* predominates from the point of view of relative abundance with 57.5% followed by *Atherurus africanus* 21.44%, *Cricetomys gambianus* 20.48%. Two constant species namely *Atherurus africanus*, *Cricetomys emini* and two accessories *Tryonomys swinderianus* and *Cricetomys gambianus* with 25%. No protected species of rodents have been inventoried.

| Table 4: Pholidota trade bushmeat in Kisangani |
|------------------------------------------------|
| **Species** | Belembo | Nebesse | Kaswena | Totaux | RA (%) | Constancy (%) | Statut |
| Phataginus tricuspis (Rafinesque 1821) | 0 | 2 | 39 | 41 | 7.63 | 25 | PP |
| Phataginus tetradactyla (Linnaeus, 1766) | 0 | 0 | 12 | 0 | 2.23 | 12.5 | PP |
| Smutsia gigantea (Illiger, 1815) | 2 | 8 | 117 | 357 | 484 | 90.13 | 37.5 | TP |
| Totaux annuels | 2 | 10 | 129 | 396 | 537 |  |  |  |
The giant pangolin is the most abundant with 90.13%; followed by Phataginus tricuspis. Although protected, two species are accessory and an incident with 12.5% constancy.

Table 5: Hyracoidea bushmeat trade in Kisangani

| Species                        | Nebesse 2016 | Kaswera 2016 | Total | RA (%) | Constancy (%) | Statut |
|-------------------------------|--------------|--------------|-------|--------|---------------|--------|
| Dendrohyrax dorsalis (Frase, 1855) | 279          | 0            | 279   | 64.88  | 12.5          | NP     |
| Dendrohyrax arboreus (A. Smith, 1827) | 0            | 151          | 151   | 35.12  | 12.5          | NP     |
| Total                         | 279          | 151          | 430   |        |               |        |

Both species of Hyracoidea are accidental on the market.

Other groups such as Elephant and Tubilidentes are less abundant as shown in tables (6 and 7).

Table 6: Elephant bushmeat trade in Kisangani

| Species                          | Sakananu 2006 | Nebesse 2014 | Kaswera 2016 | Total | RA (%) | Constancy (%) | Statut |
|----------------------------------|---------------|--------------|--------------|-------|--------|---------------|--------|
| Loxodonta africana (Blumenbach, 1797) | 64            | 2            | 322          | 388   | 100    | 37.50         | TP     |

388 elephant meatsheet

Table 7: Tubilidentes bushmeat commercialization in Kisangani

| Species                          | Sakananu 2006 | Nebesse 2014 | Nebesse 2016 | Kaswera 2016 | Total | RA (%) | Constancy (%) | Statut |
|----------------------------------|---------------|--------------|--------------|--------------|-------|--------|---------------|--------|
| Orycteropus afer (Pallas, 1766)  | 9             | 6            | 14           | 26           | 55    | 100    | 37.50         | TP     |

Table 8: Carnivora bushmeat commercialization in Kisangani

| Espèces                           | Bélembo 1976 | Bélembo 1997 | Nebesse 2016 | Nebesse 2016 | Total | RA (%) | Constancy (%) | Statut |
|-----------------------------------|--------------|--------------|--------------|--------------|-------|--------|---------------|--------|
| Aonyx congicus (E. Lonnberg, 1910) | 1            | 0            | 0            | 0            | 1     | 0.17   | 12.5          | NP     |
| Osbomictis piscivora J. A.Allen 1919 | 0            | 0            | 0            | 440          | 440   | 73.21  | 12.5          | TP     |
| Bdeogale nigripes (Pucheran, 1855) | 0            | 1            | 159          | 0            | 160   | 26.62  | 25            | NP     |
| Total                             | 1            | 1            | 159          | 440          | 601   |        |               |        |
Big game is rare, new species like Osbornictis piscivora are currently targeted for sale the same for bats.

Table 9: Chiroptera commercialization in Kisangani

| Species                        | Belembo | Ndjoku | Nebesse | Musaha | Total | RA (%) | Constancy (%) | Statut |
|--------------------------------|---------|--------|---------|--------|-------|---------|---------------|--------|
| Eidolon helvum (Kerr, 1792)    | 235     | 2487   | 861     | 3034   | 6617  | 76.9    | 37.5          | NP     |
| Eomops frangeti (Tomes, 1860)  | 235     | 280    | 93      | 15     | 623   | 7.25    | 37.5          | NP     |
| Hypsignathus monstruosus (Allen, 1861) | 235 | 483    | 106     | 147    | 971   | 11.3    | 37.5          | NP     |
| Rousettus aegyptiacus (Geoffroy, 1810) | 0       | 315    | 0       | 19     | 334   | 3.8     | 25            | NP     |
| Myonycteris torquata (Dobson, 1878) | 0       | 0      | 0       | 51     | 51    | 0.59    | 12.5          | NP     |
| Total                          | 705     | 3565   | 1060    | 3266   | 8596  |         |               |        |

More than 8596 bats were sold in Kisangani during the study period. Bat species with considerable biomass dominate relative abundance. This is the case of Eidolon helvum (76.9%), Hypsignathus monstruosus (11.3%). From the point of view of constancy, four species proved to be accessory and accidental.

Table 10: Global occurrences per animal groups

| Species                        | Number | Non protected species | Protecte species | Percentage | Protecte species |
|--------------------------------|--------|-----------------------|------------------|------------|------------------|
| Primates                       | 11 NP and 6 P | 25385 | 23.31 | 3263 | 35.47 |
| Artiodactyla                   | 5 NP and 8P | 41543 | 38.15 | 4904 | 53.31 |
| Rodentia                       | 4 NP | 32346 | 29.70 | 0 | 0 |
| Pholidota                      | 3P | 0 | 0.00 | 537 | 5.84 |
| Hyacoidae                      | 2 NP | 430 | 0.39 | 0 | 0 |
| Carnivora                      | 2 NP and 1P | 601 | 0.55 | 440 | 4.78 |
| Tubilidentata                  | 1P | 0 | 0.00 | 55 | 0.6 |
| Elephantidae                   | sheet | 0 | 0.00 | 388 sheet |  |
| Chiroptera                     | 5 NP | 8596 | 7.89 | 0 | 0 |
| Total                          | 108901 | 9199 |         |               |        |

A total of 08901 occurrences were highlighted. Considering the occurrences by group, we find ourselves in front of a rather shocking situation with 53.3% of ungulates protected, 35.47% of protected primates, pangolins and small carnivores marketed for their meat.

V. DISCUSSIONS AND CONCLUSIONS

The study focused only on game birds regularly marketed in urban and rural markets of Kisangani as a source of protein and therefore for food purposes. Based on the previous work on this trade the study wants to appreciate the constancy of the species and to follow the evolution of the sales in recent years. It reveals 118090 specimens belonging to about forty species. The species fully
protected by Congolese law are reported on the markets with 9199 cases or 8.44%. These include pangolins, aardvark, water snappers, wild pigs, tragelaphes, buffaloes, colobus, chimpanzees, bonobos, gorillas, okapis and elephants. Basa et al., (2017) pointed to non-compliance with regulations in this sector. The Artiodactyls predominate in terms of relative abundance (38.15%) followed by rodents (29.7%), Primates (23.3%), and Chirottera (7.89%). Pangolins represent 5.84%, Carnivores (4.78%), Aardvark (0.6%), Hycroacides (0.39% damans) and 388 pieces of elephants.

Belombo et al., (2003) state that the examination of 5662 carcasses inventoried at the Kisangani market indicated that the Artiodactyls (Philantoma monticola, Cephalophus nigrifrons, Cephalophus dorsalis), the Primates (Cercopithecus ascanius, Cercopithecus mitis, Cercopithecus hamlyni, Cercopithecus l’hoesti) and rodents (Atherurus africanus, Cricetomys emini) were, in order of importance, the most popular game. They had counted about twenty species of Mammals except the Cercocebe that were not observed. Van Viêt et al., (2012) in a study of the bushmeat trade in Kisangani reported 18 species recorded in 2002 and 22 species in 2008-2009. They estimated rodents and ungulates at 78% for 2002 and 68% for 2008-2009. The number of carcasses had increased by 44% between 2002 and 2009. We note that the climb continues until these days.

Constant species in markets with constancy over 50% are highly valued by the population and contribute enormously to diet and protein balance in many families in Kisangani City. Their price and the high demand depend as well on their fresh quality as on the preference of the consumers. For Artiodactyls, It is: Philantoma monticola, Cephalophus dorsalis, Cephalophus nigrifrons, Cephalophus sylyculor, Hyemoscus aquaticus, Tragelaphus spekei, Potamochoeurus porcus. For Primates: Cercopithecus ascanius, Cercopithecus hamlyni, Cercopithecus hoesti, Cercopithecus mitis, Cercopithecus neglectus, Cercopithecus mona, Colobus angolensis, Lophocebus albigena, Papio anubis, Pliocolobus badius.

About Rodents, we mention Atherurus africanus and Cricetomys emini. Species not listed are either incidental or incidental. The observation made when monitoring species per year is that some species have almost disappeared from the market over time (the case of the Cercocebs); on the other hand, many have seen a considerable rise. This is justified by the growing demand for meat and consequently the gradual disappearance of food taboos and taboos in Kisangani, a city where the mixing of cultures and traditions within communities is becoming more and more felt.

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The constant species, on the other hand, are either very prolific, occupy several ecological niches or even post-disturbed habitats or are easily captured by hunters. However, the market for game continues to evolve, as the results show new species inventoried for the first time such as Osbornictis piscivora which did not have a considerable market value formerly. Tryonomytis or grasscutters are savannah and invade progressively degraded forest areas. Gorillas and most protected species are sold in secret and thus difficult to be inventoried by the investigators. A final explanation is that the identification of species has improved a lot compared to the last ten years including capitalizing the DNA analysis of the tissues from the game. The study conducted by Dimitri (2014) reports on the diversity of species involved in the bushmeat trade in the Kisangani region by means of DNA barcodes of the fragmented mitochondrial DNA cytochrome c oxidase subunit I (IOC) and cytochrome b. An identification success rate of 65% was achieved through the study associated with vernacular names in local languages.

Given the results copied in this study, we conclude that the levies and charted demand of the wild sheptel continues to grow. Some species have disappeared from the sales channel or have seen their numbers increase in recent years; new species had a considerable score. Thus, the pressure exerted on all species sold without any exception is a danger to their sustainability and has a galloping pace over the last decade. Species are exploited regardless of their protection status.

Efforts should be made at all levels for the protection and conservation of biodiversity, and studies are continuing to ensure statistics on the exploitation of wild sheptel, such as the volume of meat sampled annually, their densities and the dynamics of the species. populations in the forest. Reconcile supply and demand; otherwise overexploitation will result in the local disappearance of certain species. Promote and ensure the development of alternative protein resources such as fish farming, poultry farming, and domestication of highly valued wildlife species.

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