MAMMALS OF THE ZAMBEZIAN WOODLAND AREA : A NUTRITIONAL AND ECOLOGICAL APPROACH*

Les mammifères de l'aire des forêts claires : une approche nutritionnelle et écologique. *

F. MALAISSE * & G. PARENT **

RESUME

Les auteurs rappellent en premier lieu, combien les grands mammifères étaient abondants et diversifiés en région zambézienne au début du siècle. Cette source de protéines fut largement utilisée par les colonisateurs et leurs collaborateurs, qui toutefois ne la considérèrent guère comme une ressource renouvelable, bien que ces ongulés, s'alimentant en équilibre avec leur environnement, représentent un niveau élevé d'adaptation écologique et une voie rationnelle de planification et d'aménagement du territoire.

Le présent article passe en revue, pour la première fois, la valeur alimentaire de 22 de ces produits et discute le grand intérêt de cette ressource.

ABSTRACT

The authors first recall that it was not unusual, at the beginning of the century, to find between twenty and

---

* Note 60 of the Contribution to the woodland ecosystem (Miombo).

** Laboratoire de Botanique et d'Ecologie, Université de Lubumbashi, B.P. 3429, Lubumbashi, Zaïre.

*** Laboratoire de Chimie, Université de Lubumbashi (à présent Mission belge de Coopération, B.P. 81, Kigali, Rwanda).

thirty different species of wild herbivores, living in a same area, in South Central Africa. But Europeans who colonised the country used wildlife as an often unacknowledged food supply for themselves and their labour force and did not regard wildlife as a renewable resource, even if those ungulates, feeding together in balance with their environment represent an extremely high degree of ecological adaptation and a valuable land use planning and management.

The paper reviews, for the first time, the nutritional values of 22 items and discusses the great interest of this resource.

INTRODUCTION

Game was, and is still, the main source of animal protein for millions of people in tropical Africa. Although it appeared on the menu at feasts for hundreds of thousands of explorers, colonials, officials and foreign staff, surprisingly it only appears in two items in the lists of Africa food products published by the F.A.O. fifteen years ago (WU LEUNG, 1970). In fact, only studies dealing with the hippopotamus (fresh and dried meat) and with the kudu antelope, *Alcephalus strepsiceros* (dried meat), are noted. The accounts of the first travellers to Upper Shaba all show the area to be rich in game and relate hunting exploits (MOLONEY, 1983; SHARPE, 1956). Hence the Pombeiros, during their crossing of Katanga in October 1806, tell how several times they received meat (VERBEKEN & WALRAET, 1953 : 65, 66), while MOLONEY (1893) says "game abounded, and was by no means shy; hence the porters received a good meal at fairly short intervals" and "the whole face of the meadow was alive with buffalo and antelope " or again "when Captain Bodson shot twelve antelope in one afternoon". DOKE (1931) writes "Ilamba, the land of the Lambas, is rich hunting country. Game of almost every kind abounds. In 1913, one could stand on an anthill and choose one's breakfast from any of ten or more species feeding with apparent unconcern". VERDICK (1951) states "On the journey to Lofoi in May 1891, as far as the eye could see stretched large herds of buffalo, zebra, a large variety of antelope of all sizes". As for Sharpe, he notes that in 1906, hunting formed a part of his daily work, game being the only source of meat. The same author also writes "one could not enter the bush without seeing herd after herd -

		Kibemba dialect
Order Primates		
Galagidae		
Galago senegalensis E.Geoffroy	Night-ape	Kabundi
Galago crassicaudatus E.Geoffroy	Bush baby	Kyanga
Cercopithecidae		
Cercopithecus aerhiops Linn.	Vervet monkey	Kapenge, Kakelekete
Cercopithecus mitis Wolf	Blue monkey	Sange
Papio cynocephalus Linn.	Yellow Baboon	Kolwe
Order Carnivora		
Mustelidae		
Mellivora capensis Schreber	Honey badger	Kambole
Aonyx capensis Schinz	Clawless otter	Bumpe
Order Tubulidentata		
Orycteropodidae		
Orycteropus afer Pallas	Ant bear	Mpendwa
Ungulates		
Elephantidae		
Loxodonta africana Blumenbach	African elephant	Nsofu
Rhinocerotidae		
Diceros bicornis Linn.	Black rhinoceros	Kipembele
Equidae		
Equus burchelli Gray	Zebra	Ingolo
Suidae		
Potamochoerus porcus Linn.	Bush pig	Ngulube
Phacochoerus aethiopicus Pallas	Warthog	Mungili
Hippopotamidae		
Hippopotamus amphibius Linn.	Hippopotamus	Infubu
Bovidae		
Cephalophus monticolus Thunberg	Blue duiker	Kabuluku
Sylvicarpa grimmia Linn.	Common duiker	Impombo
Raphicerus sharpei Thomas	Sharpe's grysbok	
Ourebia ourebi Zimmermann	Oribi	
Oreotragus oreotragus Zimmermann	Klipspringer	Kipomo
Redunca arundinum Boddaert	Reedbuck	Mpoyo
Kobus defassa Rueppell	Defassa Waterbuck	
Kobus leche Gray	Lechwe	Ingya
Aepyceros melampus Lichtenstein	Impala	Impala
Hippotragus equinus Desmaret	Roan antelope	Mpelembe
Hippotragus niger Harris	Sable antelope	Kantanta
Alcelaphus lichtensteini Peters	Hartebeest	Nkonshi
Tragelaphus scriptus Pallas	Bushbuck	Kisongo
Tragelaphus spekei Sclater	Sitatunga	Nsobe
Tragelaphus strepsiceros Pallas	Kudu	Ntengwa lukasa
Taurotragus oryx Pallas	Eland	Nsefu
Syncerus caffer Sparrman	Buffalo	Imboho

Table I : Mammals commonly eaten in the Zambezian woodland area.

and what herds ! "or" At first in Elisabethville, I killed much game" (SHARPE, 1956). One document illustrates perfectly the omnipresence of game at the beginning of the colonial era : the photograph of the rhinoceros killed in 1909 in the present square in front of the Post Office of Elisabethville (at present Lubumbashi)(SHARPE, 1956 : 72). At the beginning of the 20th century more than 30 mammals, excluding rodents for whom a special study has been made (MALAISSE & PARENT, 1982), were regularly eaten in Upper Shaba (Table I). Many of these, 70 years later, have disappeared or become very rare : this is notably the case of *Kobus leche* , of *Aepyceros melampus* (HEYMANS, 1971), of *Diceros bicornis*, of *Ourebia ourebi* and of *Orycteropus afer* . The extinction of these species has been reflected by drastic reductions in other mammal populations, mainly due to the development of large mining towns. Thus it is high time to establish the nutritional values of this food source, which for centuries formed the major part of the diet in hunter-gatherer civilizations.

ENVIRONMENT

Woodlands represent 12.1 per cent of Africa. They are distributed into two blocks, a narrow strip situated north of the equator and a massive ensemble in the Zambezian domain. This last ensemble includes the major part of Angola, Southern Shaba, the southeastern and southern parts of Tanzania, Malawi, Zambia and a great part of Mozambique and Zimbabwe. The macroclimate of the Zambezian woodland area is essentialy characterized by the annual cycle of a wet season (three to six months) and a dry season (five to nine months). The mean annual rain precipitation varies from ca 540 to 1810 mm, with a mean value around 1100 mm. The annual temperature varies from 17°2 to 26°4, with a mean of about 22° C. The temperature is lowest at the beginning of the dry season and may reach 0° C from time to time in the southern part of the area (MALAISSE, 1978).

In Southern Shaba woodlands cover about 85 per cent of the country. In these woodlands are found high termitaria built by *Macrotermes falciger*. Beside the woodlands, accessory vegetation includes periodically flooded savannas locally called *dambo*, patches of dry dense forest or *muhulu*, forest galleries among streams or *mushitu*, derived savannas and abandoned fields surrounding the villages or *mashamba*, and alluvial savannas along rivers. Though of reduced surface area, these va-

Scientific name	Energy Kj	Cals	Water g	Protein g	Fat g	Ash g	Ca mg	P mg	Fe mg
Galago crassicaudatus	723	173	68.6	20.7	9.4	1.3	160	200	0
Cercopithecus aethiops	468	112	69.5	23.7	1.2	1.4	-	-	-
Cercopithecus mitis	493	118	72.6	21.4	3.0	1.3	-	-	-
Papio cynocephalus	468	112	71.2	22.3	1.8	1.0	-	-	-
Loxodonta africana[a]	647	155	64.5	31.2	2.4	1.1	10	215	7
Potamochoerus porcus[a]	906	217	41.3	45.9	2.3	1.9	40	300	6
Phacochoerus aethiopicus[a]	906	217	51.5	43.0	3.7	1.8	60	300	8
Hippopotamus amphibius[a]	1103	264	48.2	32.6	13.8	1.3	20	100	10
Cephalophus monticolus	510	122	72.0	22.0	3.1	1.4	-	-	-
Sylvicapra grimmia[a]	714	171	55.8	35.6	2.1	1.8	30	300	10
Raphicerus sharpei	505	121	73.3	19.7	4.4	1.1	20	160	8
Oreotragus oreotragus[a]	551	132	67.2	27.0	1.9	1.4	30	260	7
Redunca arundinum[a]	906	217	52.5	42.0	4.2	1.4	25	400	5
Kobus defassa[a]	990	237	41.1	52.0	1.7	1.4	5	420	8
Hippotragus equinus[a]	1290	309	33.4	58.3	6.7	1.2	40	450	10
Hippotragus niger[a]	1019	244	45.8	48.7	4.0	1.6	50	270	10
Alcelaphus lichtensteini[a]	881	211	46.0	46.2	1.5	1.9	50	430	0
Tragelaphus scriptus[a]	789	189	51.9	41.9	1.1	1.7	25	320	15
Tragelaphus spekei[a]	706	169	58.0	36.0	1.7	1.2	60	350	7
Tragelaphus strepsiceros[a]	656	157	61.5	33.7	1.5	1.7	80	270	8
Taurotragus oryx[a]	535	128	66.0	29.2	0.4	1.3	60	210	7
Syncerus caffer[a]	702	168	61.2	34.5	2.3	1.7	60	120	6

Table II : The nutritional value of several mammals from Lubumbashi in the Zambezian woodland area (Amount per 100 g of raw muscle of the disemboweled animal. Samples marked with an [a] were smoked).

rious ecosystems, responding to particular ecological conditions, are important. Their biocenosis enlarges appreciably the richness of the fauna of the country, which includes several edible wild animals.

MATERIAL AND METHODS

The present paper deals with Mammals, excluding Rodents. About 30 Mammals are eaten by local populations in the Lubumbashi surroundings. We are able to establish the vernacular name in Kibemba dialect for 28 of them (Table I). Twenty-two of them were sampled.

The experimental methods of specimen preparation and the analyses performed have been described previously (PARENT & THOEN, 1977; MALAISSE & PARENT, 1985). In Table II energy values per 100 grams are obtained by adding the protein content x 4.27 and the fat content x 9.02 (MERRILL & WATT, 1955). The water, protein, fat and ash content are expressed in percent per 100 grams of each specimen, whilst that of calcium, phosphorus and iron are given in milligrams for the same weight.

RESULTS

The food value of the 22 samples analysed is noted in Table II, which shows a fairly wide spectrum of values (from 468 to 1290 Kj) with a mean of 749 Kj $\pm$ 228. The Cercopithecidae show the lowest values ($\bar{X}$ = 476 Kj) ; the Hippotragini and the Hippopotamus the highest.

Our values differ from the three results published previously (WU LEUNG, 1970) to a certain extent. Thus our value for the kudu is higher (211 as against 150) whilst that for the hippopotamus is lower (264 as against 368); but it should be noted that the methods of treating or preparing the meat are generally different.

Hippopotamus meat is characterized by its very high fat content. A high fat content is also found in the Bushbaby, and to a lesser extent, in members of the Hippotragini tribe. The mean content is of 3.4 % and corresponds to the value of 3.23 published by HOOGESTEIJN-REUS (1981) regarding wild ungulates. Ash content varie little (1.0 - 1.9 g per 100 g) ; the mean being 1.45. Average contents of P, Ca and Fe are 282 , 46 and 7.3 mg per 100 g respectively.

	Density per km^2	Average weight (kg)	Biomass (kg/km^2)
Wildebeest *(Connochaetes taurinus)*	1.62	195	315.6
Waterbuck *(Kobus defassa)*	1.47	147	216.4
Hartebeest *(Alcelaphus lichtensteini)*	1.47	140	206.4
Reedbuck *(Redunca arundinum)*	2.31	52	120.3
Sable *(Hippotragus niger)*	0.66	180	119.6
Zebra *(Equus burchelli)*	0.42	250	104.6
Elephant *(Loxodonta africana)*	0.02	4980	99.7
Kudu *(Tragelaphus strepsiceros)*	0.58	140	81.4
Roan *(Hippotragus equinus)*	0.23	140	32.3
Warthog *(Phacochoerus aethiopicus)*	0.39	68	26.5
Eland *(Taurotragus oryx)*	0.04	362	14.5
Lion *(Panthera leo)*	0.08	154	12.3
Common duiker *(Sylvicarpa grimmia)*	0.01	14	11.0
Bushbuck *(Tragelaphus scriptus)*	0.31	32	9.8
Spotted hyaena *(Crocuta crocuta)*	0.15	59	8.8
Sharpe's grysbok *(Raphicerus sharpei)*	0.85	7	6.2
Impala *(Aepyceros melampus)*	0.08	59	4.7
Cheetah *(Acinonyx jubatus)*	0.08	27	2.2
Baboon *(Papio ursinus)*	0.23	14	3.1
Vervet monkey *(Cercopithecus aethiops)*	0.50	3	1.6
Jackal *(Canis adustus)*	0.23	5	1.2

Table III : Game density, average weight and biomass in the Ngoma miombo (Kafue National Park, Zambia).

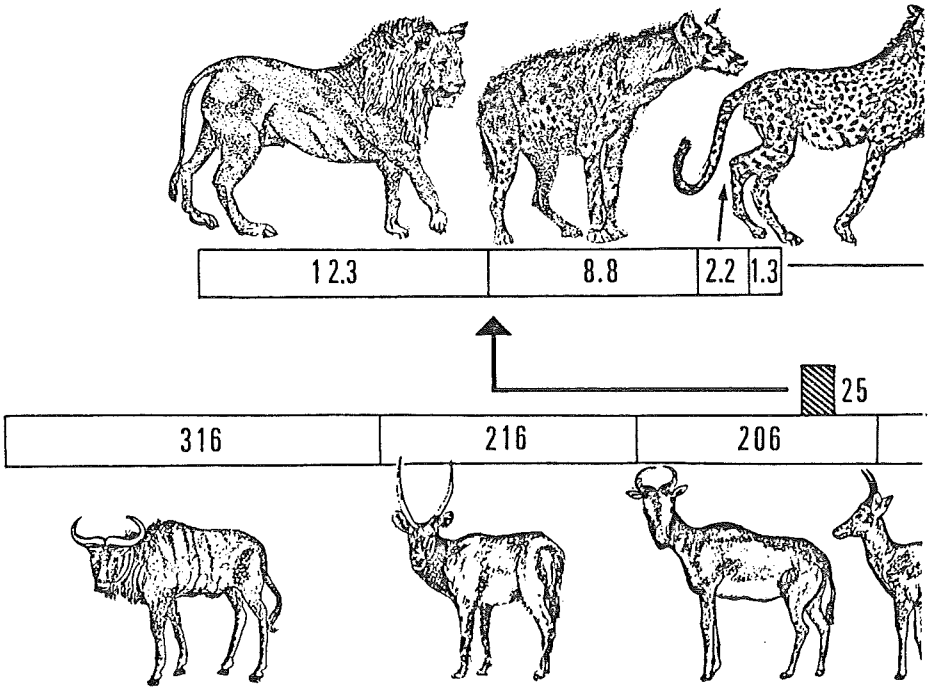
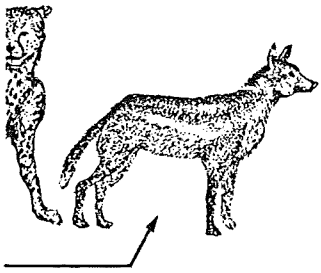
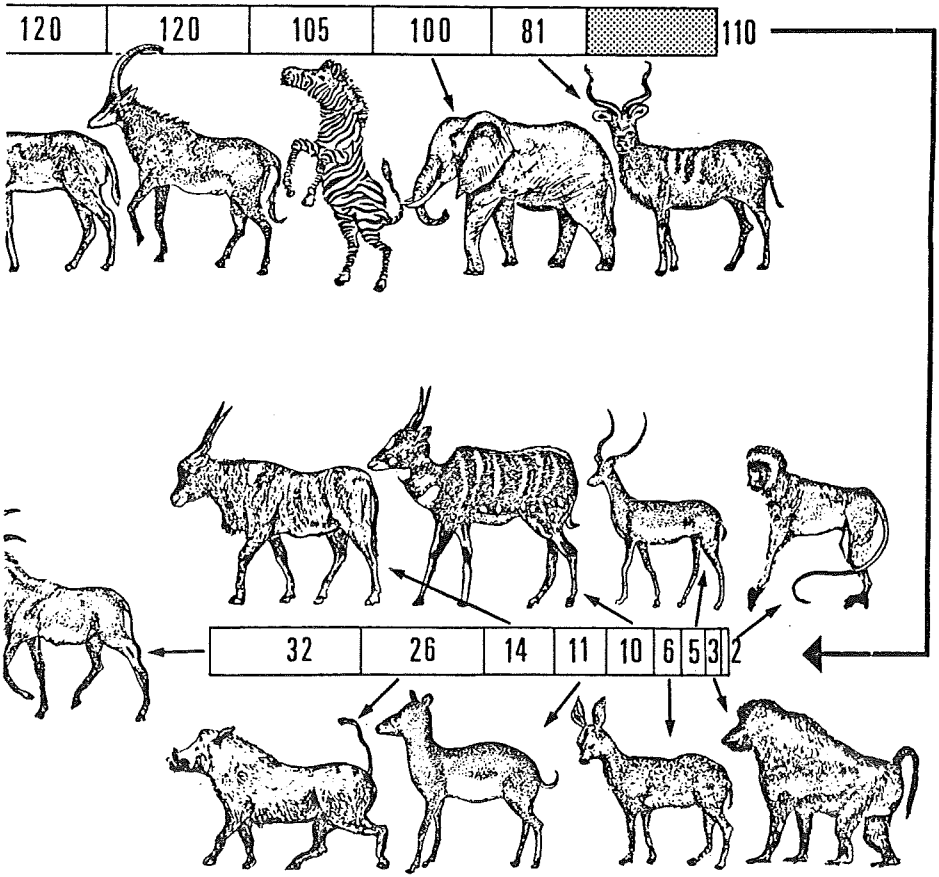


Fig. 1 : Biomass (fresh weight per km^2) of large mammals in Ngoma miombo (Zambia).
Carnivores : lion, spotted hyaena, cheetah and jackal;
Herbivores : wildebeest, waterbuck, hartebeest, reedbuck, sable, zebra, elephant, kudu, roan, warthog, eland, common duiker, bushbuck, sharpe's grysbok, impala, baboon and vervet monkey (values after DOWSETT, 1966, original figure).



kg/km²



DISCUSSION

For three million years or more, man has been eating wildlife of various kinds. In Africa an amazing variety of wildlife species are eaten, including all wild ungulates and primates (DE VOS, 1978). From the present study two main facts arise easily. Firstly, as far as the Zambezian Region is concerned, the abundance and diversity of game at the beginning of the century appear clearly from the available literature (RICHARDS, 1939). On the other hand, although there exist individual preferences, the meat of all species of wild ungulates may be readily eaten and its valuable nutritional value has been worked out.

Several questions may therefore been asked.

Firstly we may examine the game density in the studied area. Several studies (GRIMWOOD *et al.*, 1958; ROBINETTE, 1963; DOWSETT, 1966; FOSTER & COE, 1968; HEYMANS, 1971) inform on game density, average weight and biomass in natural conditions. The observations carried out during the wet season, in a self-contained ecological unit, comprising 31 km^2 of Zambezian woodland of the Kafue National Park (DOWSETT, 1966) fit well with the present study (Table III). Relative importance of herbivores versus carnivores (SCHALLER, 1972), is resumed on figure 1. From this information it is obvious that some 80 kg of fresh meat could be yearly available per square kilometre of miombo. But the reality differs greatly. Even in a few species are reported to show remarkable ability to persist in cultivated areas, e.g., common duiker and bushbuck (EAST, 1981), today the more dense human population has excluded, through poaching and through habitat modification, most larger forms of wildlife from the country. In 1931 DOKE already stated that, with the advent of the white hunter and the increase of muzzle-loading guns in the hands of the natives, game was fast diminishing. It must be admitted that game has completely disappear around the mining towns (Lubumbashi, Likasi, Kolwezi, Ndola, Kitwe, etc...) for a radius behind 150 kilometres. This heavy change of environment largely precedes the deforestation, whose regular progression has been underlined and estimated elsewhere (MALAISSE & BINZANGI, 1985). In fact, unfortunately today, for most African countries, the analysis of the eventual importance of game meat following a rational cynegetic development would seem to be an utopian idea or founded on a grotesque naïvety. This in spite of the fact that on many lands

wild animals do make more efficient use of the existing resources than domestic livestock. The available food is in the form of herbs, grasses, forbs, sedges and woody plants. The individual diets of the wild herbivores differ from one another and are frequently complementary (TALBOT, 1966; SKINNER *et al.*1983). For instance the preferred dietary component of the kudu is forbs, but woody browse is most sought after during the early growing season (OWEN-SMITH *et al.*, 1983). The work of TALBOT TALBOT *et al.* ,1965; TALBOT, 1966) develop several aspects of the comparison of wild ungulates and domestic livestock as a source of food. This author states that wild ungulates reach marketable or economically harvestable size at an earlier age than domestic livestock. For instance eland will breed when just over one year old, the females producing their first calf when about two years old. Moreover the females normally produce at least one young a year. Elands require roughly three years to reach economically harvestable size. Their water requirement is weaker, they are able to go waterless for some days and travel long distances to find water if necessary (POSSELT, 1963; TAYLOR, 1969). Moreover wild ungulates present generally a killing-out percentage exceeding 50.0. Lastly several wild mammals produce significant by product income (hides, teeth, tails, hoofs, ivory and other trophies).

In conclusion, although there is no doubt that game utilization is no panacea and certainly cannot simply replace systems based on domestic animals, it is equally clear that it has a good deal of actual and potential values as an alternative form of land use in some areas (TALBOT, 1966; HIRST & CATTO, 1975; BIGALKE, 1978). The survival of most large mammals depends on the existence of effectively protected areas. These islands of wilderness, scattered within a more "savanized landscape" decline and the area requirements of the mammals are less frequently satisfied (EAST, 1981). Therefore, national parks and nature conservation should strongly be supported, as it is presently the unique way of saving this millennial inheritance.

REFERENCES

BIGALKE, R.C., 1978. Mammals *In* M.J.A. Werger (Ed.) : Biogeography and ecology of Southern Africa, *Monographiae Biologicae* 31, 981-1048.

DE VOS, A., 1978. Game as food. *Tiger paper*, 5,3 , 1-6.

DOKE, C.M., 1931. *The Lambas of Northern Rhodesia. A study of their customs and beliefs.* London, 408 p.

DOWSETT, R.J., 1966. Wet season game population and biomass in the Ngoma area of the Kafue Park. *The Puku, Zambia* 4, 135-145.

EAST, R., 1981. Area requirements and conservation status of large African mammals. *Nyala* 7,1 , 3-20.

FOSTER, J.B. & COE, M.J., 1968. The biomass of game animals in the Nairobi National Park, 1960-66. *J. Zool. London* 155, 413-425.

GRIMWOOD, I.R., BENSON, C.W. & ANSELL, W.F.H., 1958. The present day status of ungulates in Northern Rhodesia. *Mammalia* 22, 451-467.

HEYMANS, J.C., 1971. Les antilopes de la province du Katanga. *Les Naturalistes belges* 52, 147-156.

HIRST, S.M. & CATTO, G.G., 1975. Current status and future utilization potentiel of wild ungulates on natural savanna rangeland in the Transvaal lowveld, South Africa. *In* R.L. Reid (Ed.), Proc. III World Conf. Anim. Prod. Sydney University Press.

HOOGESTEIJN-REUS, R., 1981. Potentiel des animaux sauvages sous les tropiques. *Le Courrier* 65, 72-74.

MALAISSE, F., 1978. *The Miombo Ecosystem in Tropical Forest Ecosystems.* UNESCO/UNEP/FAO. Unesco, Paris, Natural Resources Research, XIV, 589-606.

MALAISSE, F. & BINZANGI, K., 1985. Wood as a source of fuel in Upper-Shaba (Zaïre). *Commonw. For. Rev.* , 64,3 , 227-239.

MALAISSE, F. & PARENT, G., 1982. Rodents of the miombo woodland area. A nutritional and ecological approach. *Ecol. Food Nutrition* 11, 211-216.

MALAISSE, F. & PARENT, G., 1985. Wild edible vegetable products in the Zambezian woodland area : a nutritional and ecological approach. *Ecol. Food Nutrition* 18, 43-82.

MERRILL, A.L. & WATT, B.K., 1955. *Energy Values of Foods : Basis and Derivation.* U.S. Department of Agriculture, Handbook 74, 105 p.

MOLONEY, J.A., 1893). *With Captain Stairs to Katanga.* Sampson Low, Marston & Co, London, 280 pp.

PARENT, G. & THOEN, D., 1977. Food value of edible mushrooms from Upper Shaba region. *Econ. Botan.* 31, 436-445.

POSSELT, J., 1963. The domestication of the eland. *Rhod. J. agric. Res.* 1, 81-87.

RICHARDS, A.I., 1939. *Land, labour and diet in Northern Rhodesia : An Economic study of the Bemba tribe.* Oxford University, London, 214 p.

ROBINETTE, W.L., 1963. Weights of some of the larger mammals of Northern Rhodesia. *Puku,* 1, 207-215.

SCHALLER, G.B., 1972. *The Serengeti lion.* The University of Chicago Press, Chicago.

SHARPE, R.R., 1956. *En Prospection au Katanga il y a cinquante ans.* Elisabethville, 165 p.

SKINNER, J.D., MONRO, R.H. & ZIMMERMANN, I., 1983. Comparative food intake and growth of cattle and impala on mixed tree savanna. *S. Afr. J. Wildl. Res.*, 14, 1-9.

TALBOT, L.M., 1966. Wild animals as a source of food. Bureau of Sport Fisheries and Wildlife, Spec. Scient. Rep. Wildlife, Washington, 98, 16 p.

TALBOT, L.M., PAYNE, W.J.A., LEDGER, H.P., VERDCOURT, L.D. & TALBOT, M.H., 1965. The meat production potential of wild animals in Africa; a review of biological knowledge. Commonw. Agric. Bur. (England), C.A.B. Technical Communication, 16, 42 p.

TAYLOR, C.R., 1969. The minimum water requirements of some East African bovids. Symp. Zool.Soc. London, 21, 195-206.

VERBEKEN, A. & WALRAET, M., 1953. La première traversée du Katanga en 1806. Voyage des "Pombeiros" d'Angola aux Rios de Sena. *Mém. Inst. roy. col. belge,* Bruxelles, 135 p.

VERDICK, E., 1952. *Les premiers jours au Katanga (1890-1903).* Comité spécial du Katanga, Bruxelles, 199 p.

WU LEUNG, W.T., 1970. Table de composition des aliments à l'usage de l'Afrique. F.A.O., Documents sur la nutrition, 218 p.