

**IMPERIAL COLLEGE OF SCIENCE, TECHNOLOGY AND MEDICINE
Faculty of Life Sciences**

(University of London)

Department of Environmental Science & Technology

The Importance of Hunting for Bushmeat to a Rural Community in Equatorial Guinea

By

Nick Keylock

A report submitted in partial fulfilment of the requirements for the MSc.

September 2002

TABLE OF CONTENTS

ABSTRACT	i
ACKNOWLEDGEMENTS	ii
1. INTRODUCTION	1
2. BACKGROUND TO THE BUSHMEAT ISSUE	4
2.1 The Bushmeat Problem	4
2.2 The Causes	5
2.3 The Solutions	6
3. BACKGROUND TO EQUATORIAL GUINEA	8
3.1 Geography	8
3.2 People	9
3.3 Infrastructure and Economy	9
3.4 ECOFAC	10
3.5 Sendje	11
4. RESEARCH METHODS	13
4.1 Preliminary Research and Logistics	13
4.2 Research in Sendje	14
4.2.1 Familiarization exercises	15
4.2.2 Household interviews	18
4.2.3 Hunter interviews	21
4.2.4 Trader interviews	23
5. RESULTS	25
5.1 Village Life in Sendje	25
5.1.1 History	25
5.1.2 Inhabitants	26
5.1.3 Living costs	27
5.1.4 Livelihood activities	29
5.1.5 Food	31
5.2 Description of Hunting	32
5.2.1 The hunters	33
5.2.2. Hunting methods	35
5.3 Description of the Commodity Chain	41
5.3.1 The traders	41
5.3.2 Purchase of bushmeat in Sendje	42
5.3.3 Transportation of bushmeat to Bata	43
5.3.4 Sale of bushmeat in Bata Central Market	45
5.4 Sustainability of Hunting	46
5.5 Rationale for Hunting	48
5.5.1 Incentives to hunt	48
5.5.2 Alternative sources of income	51
5.5.3 Alternative sources of food	53

6. DISCUSSION	60
6.1 Key Findings and the Implications for Management	60
6.1.1 Hunting	60
6.1.2 Trading	64
6.1.3 Consumption of bushmeat	65
6.1.4 Community structure	67
6.2 Management Strategy	67
7. SUMMARY AND CONCLUSIONS	72
8. REFERENCES	74
Appendix 1	78
Appendix 2	83
Appendix 3	87
Appendix 4	90
Appendix 5	91
Appendix 6	92
Appendix 7	93
Appendix 8	96
Appendix 9	97

List of Figures

Fig. 1	12
Fig. 2	28
Fig. 3	30
Fig. 4	33
Fig. 5	33
Fig. 6	34
Fig. 7	40
Fig. 8	49
Fig. 9	49
Fig. 10	50
Fig. 11	50
Fig. 12	54
Fig. 13	54
Fig. 14	55
Fig. 15	57
Fig. 16	57
Fig. 17	58
Fig. 18	58

ABSTRACT

Research was undertaken into the role of hunting for bushmeat in the life of a small rural community in Rio Muni, the Republic of Equatorial Guinea, Central Africa. Data was collected over two-month period between the beginning of May and the end of June 2002. The study was focussed on the village of Sendje, located close to the western boundary of Monte Alèn National Park and the site of a previous study that recorded unsustainable levels of hunting in the area (Fa and Garcia Yuste 2001). Initial exercises were carried out with representatives of the community to establish the layout of the area, the composition and history of the village and the nature of the activities undertaken by the resident population. There followed a period of interviews with households (n = 41), hunters (n = 19) and bushmeat traders (n = 2) using semistructured questionnaires. It was found that hunting was almost exclusively a male activity, carried out by 61% of the men (aged 20+) in the sample, distributed amongst 80% of the households. Trapping with cable snares was the principal method of hunting. Hunting with shotguns was less widespread due to the relatively high capital and operating costs it incurred. The majority of hunters sold a proportion of the bushmeat they caught. There was a reliable customer for the meat; a trader who visited the village three times a week from Bata, the largest city on the mainland. The income earned from selling bushmeat was vitally important to the hunters and their families for meeting basic subsistence needs. Employment opportunities were scarce and the potential for private commercial enterprise was limited and thus the opportunity costs of hunting were low. Bushmeat was eaten by all households, but was not the major source of animal protein and thus did not present a major food security concern. Fish and to a lesser extent domestic meat was widely available and accepted as a substitute. The findings of the study have implications for the mitigation of hunting in the area, which is expected to be stepped up in the near future. Restricting hunting to areas outside of the national park and curbing the activities of traders would both be feasible and effective interventions. These measures would not interfere significantly with the domestic supply of bushmeat or the crop protection role of hunting. In contrast, the earnings of hunters would be reduced and thus for management to be a success there must be accompanying measures that provide acceptable alternative sources of income.

ACKNOWLEDGEMENTS

I would like to thank E.J. Milner-Gulland for her support, advice and supervision during both the planning stage and the final write-up of the project. Also I must thank Noelle Kumpel for her collaboration on all aspects of the research and for putting up with me in Equatorial Guinea for two months. The assistance, resources, contacts and advice generously given by Michael Allen and his staff at ECOFAC, Equatorial Guinea were invaluable to the success of the project, for which I am eternally grateful. Lastly, I must thank the people of Sendje for being such friendly hosts and willing participants in the research. In particular to Joaquín Masolo Nvulu, the president of the village and the two research assistants Pedro Nsue Nseng and Bienvenido Ndong Ondo.

1. INTRODUCTION

Bushmeat is the popular term used to describe ‘*wild animal protein that is hunted for human consumption*’ (Bowen-Jones *et al* 2002). It is a term most widely associated with the exploitation of wild animals in tropical regions, notably in West and Central Africa (Fa *et al* 2002a). Whilst the indigenous population of the region has been hunting wild animals for food for more than 40,000 years (Bahuchet 1993, cited in Bennett 2002), concern has grown in recent years that the level of exploitation has become unsustainable. A number of factors are attributed with creating or exacerbating this situation including burgeoning human populations, urbanization, improved technology, logging, the commercialization of bushmeat, preference for bushmeat and a scarcity of alternative sources of protein (Bowen-Jones and Pendry 1999; Robinson and Bennett 2000). So extensive is the problem that hunting for bushmeat is thought to pose an even greater threat to wildlife species and the tropical forest ecosystem than habitat destruction (Redford 1992; Wilkie and Carpenter 1999). Furthermore it threatens the livelihoods of local people that depend on the wildlife resource (Bennett 2002).

Where the existence of such charismatic animals as elephants and great apes is potentially at stake, it is not surprising that the bushmeat issue is now at the forefront of conservation debate and has become a hot topic in the popular media. This is particularly true in the UK where the existence of an international dimension to the commercial trade in bushmeat has brought the issue closer to home. After the devastation wrought on the farming community by the outbreak of foot-and-mouth disease, seizures of bushmeat at airports (Bowen-Jones *et al* 2002) and reports of restaurants in London dishing up bushmeat (e.g. Charles Campion 2002) are big news. Consequently there is a growing network of organizations forming across Europe and North America devoted to the bushmeat problem such as the Bushmeat Working Group in the U.K. and the Bushmeat Crisis Working Group in the U.S.

In spite of the bushmeat issue being a focus-point for public concern and the investment of resources into research and campaigns, bushmeat consumption and trade continues unabated (Fa *et al* 2002a). As yet there are no clear solutions to the problem of unsustainable exploitation of bushmeat (Bowen-Jones *et al* 2002). Certainly there are

unlikely to be any simple, generalizable solutions to a situation that is geographically variable and highly complex such that both conservation objectives and the socioeconomic needs of local people with a stake in the bushmeat trade must be met (Noss 1997; Bowen-Jones *et al* 2002). Nevertheless interest has been growing in finding ways of mitigating the negative impact of hunting for bushmeat and a range of measures have been suggested (e.g. Wilkie and Carpenter 1999). Evaluating the feasibility and effect of these measures requires an understanding of the context in which they might be implemented (Milner-Gulland and Mace 1998). Data is particularly scarce regarding the role played by bushmeat in diet and household income (Wilkie and Carpenter 1999; Davies 2002). This is of crucial importance because the significance of bushmeat '*to local economies is likely to be the single most important barrier to mitigating over-exploitation*' (Wilkie and Carpenter 1999).

Within the west and central African region, the Republic of Equatorial Guinea has been relatively understudied; the majority of published studies having looked at urban markets, in particular on Bioko Island (Bowen-Jones 1998). In contrast, a study by Fa and Garcia Yuste (2001) looked at the extent and impact of hunters operating in a rural area of the mainland region of the country. They recorded high, but declining levels of bushmeat extraction and concluded that hunting pressure there was unsustainable. The location of this study, the village of Sendje, lies at the edge of a recent extension to the largest protected area in the country, Monte Alèn National Park (ECOFAC 2002). Just as with other settlements on the periphery of the park there is a conflict here between the activities of the villagers and conservation objectives of the park (Garcia Yuste 1995). Consequently plans are afoot to resolve this conflict and address the problem of bushmeat extraction from Monte Alèn National Park.

Sendje therefore offers an ideal opportunity to examine the role hunting plays in a rural community and the implications for any management intervention. The hope is that this investigation can offer guidance as to how the problem of hunting for bushmeat can be managed in Sendje and provides a case study that has relevance to the management of hunting elsewhere. This aim of the study will be achieved by meeting the following research objectives:

- To describe the level of participation in hunting within the village relative to other livelihood activities.
- To describe the activities of hunters in terms of the methods of hunting used and the temporal and spatial pattern of hunting.
- To determine the sustainability of current hunting pressure.
- To determine the contribution made by wild meat to household income and diet.
- To evaluate the current importance and potential of alternative sources of income and substitute foods.
- To describe the commodity chain between hunter and urban consumer.
- To assess the implications of the findings for the management of hunting.
- To recommend a management strategy to mitigate the impact of hunting in the area.

2. BACKGROUND TO THE BUSHMEAT ISSUE

2.1 The Bushmeat Problem

Bushmeat is potentially an issue anywhere that wild animals are exploited for food. The term, however, has come to be associated with people living in tropical forested regions of the world, where bushmeat has always been a mainstay of the local diet largely due to the lack of alternative sources of protein (Wilkie and Carpenter 1999). The regions of the world that the issue principally concerns are therefore North and Central Latin America, West and Central Africa and South-East Asia. Of these, the continent that receives the most attention from academics and conservation organisations is Africa. This apparently disproportionate emphasis on Africa is most likely due to two important factors. Firstly, the rainforests of Equatorial Africa are home to three of the four species of great ape: the bonobo (*Pan paniscus*), chimpanzee (*Pan troglodytes*) and gorilla (*Gorilla gorilla*) and many of the organisations spear-heading the bushmeat campaign are principally concerned with primate conservation (Bowen-Jones 1998). Secondly, consumption of bushmeat is greatest in Africa. Estimates are highly variable but the trend is clear (Table 1). This is due in part to the fact that in Asia the deforestation and defaunation is much further advanced leaving little left to eat and in Amazonia the population density is much lower than that in Africa (Bennett 2002).

Table 1. Estimations of annual bushmeat extraction in tropical regions of Africa and South America.

Study authors	Region	Bushmeat extraction (10 ³ tonnes per year)
Robinson and Redford (1991)	Brazilian Amazon	67– 164
	Central Africa	1,000 – 3,400
Fa <i>et al</i> (2002a)	Amazon Basin	150
	Congo Basin	4,900
Wilkie and Carpenter (1999)	Congo Basin	1,000

Animal biomass and production in tropical forests is relatively low compared to other habitats like, for example, savannah (Wilkie and Godoy 2001) such that one square kilometre of forest can only provide for the protein needs of one person (Bennett and Robinson 2000). In West and Central Africa, the average population density in forested

areas is 99 people per square kilometre. Fa *et al* (2002a) estimate that in the Congo Basin, the annual production rate of mammals would have to be equivalent to 93% of their body mass to meet current extraction rates of bushmeat. It is statistics like these that support the notion that current levels of exploitation are unsustainable. This raises the possibility of the following phenomena:

- Prey species will become locally if not completely extinct, as appears to have recently occurred in West Africa with a sub-species of primate; Miss Waldron's red colobus (*Piliocolobus badius waldronae*) (Oates *et al* 2000).
- The integrity of the forest ecosystem will be undermined as a result of changes to species interactions such as predation, competition, seed dispersal and nutrient recycling (Wright *et al* 2000; Wilkie and Godoy 2001).
- The people indigenous to the region will lose an important source of protein and income, on which many are currently dependent (Wilkie and Carpenter 1999). This may present a serious food security issue, depending on the availability or potential of alternative food sources (Bennett 2002).

2.2 The Causes

As alluded to above, the steady rise in human populations in tropical rainforests, the highest being in Africa (annual rate is 2.66%), is a key factor in the creation of a bushmeat problem (Bennett 2002). Not only has the population risen, it has also become increasingly urbanized (Bowen-Jones and Pendry 1999). For example the urban population rose from 43.2% to 48.2% of the total population in Equatorial Guinea between 1996 and 2000 (World Bank 2002). This urban demand for bushmeat combined with an improved infrastructure and development of a market economy has led to the creation of a commercial trade in bushmeat in many countries (Bowen-Jones 1998). This development has been facilitated to a large extent by the activities of logging companies in the region. They have been responsible for the construction of much of the transport infrastructure providing access to previously remote areas (Wilkie and Carpenter 1999). In addition, there are many reports implicating logging company employees and vehicles directly in the trade (in Bowen-Jones 1998).

2.3 The Solutions

There is no shortage of ideas as to how to mitigate the over-exploitation of wild animals for bushmeat (Bowen-Jones 1998; Bowen-Jones and Pendry 1999; Wilkie and Carpenter 1999; Milner-Gulland 2001; Wilkie and Godoy 2001; Bowen-Jones *et al* 2002). All of the measures work by increasing the costs of hunting; either actual or opportunity costs (Milner-Gulland 2001). The measures proposed can be subdivided according to:

- i. whether they address either the issue of supply or demand (Wilkie and Carpenter 1999);
- ii. which stakeholder(s) in the supply chain, from hunter through to consumer, the measure targets (Milner-Gulland 2001);
- iii. whether they are coercive, forcing people to change their behaviour (requiring regulation and enforcement), or persuasive, offering opportunities that encourage a change of behaviour (Milner-Gulland 2001).

The list of measures that follows is in no way comprehensive but highlights the major options relevant to the situation encountered in a rural community such as Sendje.

Measures targetting hunters include:

- restricting the weapons used by hunters such as cable snares or shotguns (Milner-Gulland 2001);
- setting quotas for bushmeat extraction according to estimates of population densities and production rates of prey species (Bowen-Jones and Pendry 1999);
- designating protected areas in which all hunting is banned (Bowen-Jones and Pendry 1999);
- designating closed seasons for hunting (Bowen-Jones and Pendry 1999);
- strengthening traditional resource use rights to encourage sustainable use and to exclude outsiders (Bowen-Jones and Pendry 1999);
- increasing the abundance of prey species by stocking areas of forest or by manipulating the ecosystem to increase productivity and/or reduce mortality (Wilkie and Godoy 2001);

- establishing a flexible system of zoning whereby hunters are restricted in where they can hunt according to monitored levels of hunting pressure (Wilkie and Carpenter 1999).

Measures targetting intermediaries include:

- taxing the transportation of bushmeat (Bowen-Jones and Pendry 1999);
- inspecting urban markets and imposing fines or making arrests for selling illegal meats (Milner-Gulland 2001).

Measures targetting consumers include:

- education programmes designed to reinforce traditional taboos on eating certain types of bushmeat (Bowen-Jones and Pendry 1999);
- providing cheap alternative sources of protein in the form of captive-bred bushmeat species such as cane rats (*Thryonomys swinderianus*), or by developing livestock-rearing (Heymans 1994; Wilkie and Carpenter 1999).

3. BACKGROUND TO EQUATORIAL GUINEA

3.1 Geography

The Republic of Equatorial Guinea is a small country in western Central Africa. It is made up of two major provinces, a mainland region known as Rio Muni and the volcanic island of Bioko plus four smaller islands; Annobon, Elobey Grande, Elobey Chico and Corisco (Figure 1). Bioko Island (formerly Fernando Po), with an area of 2,017 square kilometres, is the largest Island in the Gulf of Guinea. It lies just 40 kilometres to the west of Cameroon. Rio Muni is significantly larger, covering 26,003 square kilometres. It is situated just two degrees north of the equator, bordered by Gabon to the east and south, Cameroon to the north and the Atlantic Ocean to the west. It is on this mainland region that research for this project was carried out.

The climate is typical of a tropical country: hot and humid. The temperature fluctuates between 17°C and 32°C and monthly rainfall varies between 1665mm and 2470mm (Niefang weather station, Lasso Alcala 1995). There are four seasons that can be distinguished according to the pattern in precipitation. There are two dry seasons: December to February and June to August. Of the two intervening wet seasons, the wettest period is from September through to the end of November (Gonzalez-Kirchner 1994).

The western coastal strip of Rio Muni is flat and low-lying. Further east, the land has a more dramatic relief, rising to an elevation of over 1000 metres forming the western extension of the Crystal Mountains (FAO 2002). Much of the inland region is still thickly forested, with moist tropical lowland and upland forest, despite the activities of the logging companies, contributing to an annual deforestation rate of about 0.6% (FAO 2002). The forest, covering 61% of the land area of Rio Muni is approximately 48% primary forest, 50% secondary forest and 2% mangrove forest (FAO 2002).

3.2 People

The population numbers some 486,000 (July 2001 estimate, CIA 2002) and has been growing at an annual rate of approximately 2.7% since 1996 (World Bank 2002). The population on Bioko Island (approximately 62,000 people) is largely confined to Malabo, the capital city (Fa *et al* 2002b). The majority of the population lives on Rio Muni, of which some 50,000 are resident in Bata, the principal city on the mainland (Figure 1). Away from the urban areas, where half of the people now live, and away from the coast, the population density is very low (World Bank 2002).

The majority of Equatoguineans are of Bantu origin. The dominant ethnic group is Fang, accounting for about 80% of the population. The Fang are indigenous to the mainland region and are also predominant in southern Cameroon and northern Gabon. The other major ethnic group, the Bubi, constituting about 15% of the population, are indigenous to Bioko Island (Fa *et al* 2002b). The remaining 5% of the population is comprised of a number of smaller coastal and island tribes plus a growing community of immigrants and expatriates from neighbouring Cameroon, Gabon, Nigeria and also from Spain, France and the USA (U.S. Department of State 2002). The majority of the population therefore speaks Fang and Spanish, the official language of the country. Since 1997, French has become the country's second official language and is now also commonly used (U.S. Department of State 2002). Whilst traditional beliefs are still widely held, the majority of the population is nominally Christian and mostly Roman Catholic (CIA 2002).

3.3 Infrastructure and Economy

Equatorial Guinea was formerly a Spanish colony. In 1963, the country was granted limited autonomy and in 1968 it became an independent state. Under the autocratic rule of Francisco Macias Nguema, between 1968 and 1979, the country fell into ruin; a third of the population was either killed or fled the country and the infrastructure collapsed (U.S. State Department 2002). This is an important point to make because the country is still, to some extent, recovering from this devastating period in its history. Of particular relevance is the state of the transport network; there is no rail system, the main

waterways are not used and the road network is very limited and of variable quality with little more than 700 kilometres of paved road (U.S. State Department 2002).

Despite these depredations, the country is currently enjoying sustained and rapid economic growth. Annual growth in gross domestic product has ranged between 16.9% and 71.2% in the last five years and is predicted to continue (EIA 2002). This is largely due to development in the energy industry, in particular in offshore oil. With the help of huge foreign investment, principally from the U.S., Equatorial Guinea has become a major player in what is one of the most promising oil-producing regions in the world (EIA 2002). Timber is the next biggest source of foreign currency. Exports of timber have steadily grown in recent years driven by a growing demand from Asia (U.S. State Department 2002). Other major exports are coffee and cocoa, but neither of these industries has fully recovered to pre-independence levels of production (U.S. State Department 2002).

This rapid growth in the economy is evident from the multitude of construction projects underway, particularly in and around Bata (*pers. obs.*) as oil and natural gas exploration focuses increasingly on the area offshore Rio Muni (EIA 2002). Such rapid growth has been associated with a high rate of inflation for consumers (6% in 2001, EIA 2002). The difficulty for consumers is compounded by the country's dependence on imported manufactured goods, from countries such as Cameroon and Spain. With import tax set at 50%, the prices for these goods can be very high; a good from Cameroon may have trebled in price by the time it reached a consumer in the rural areas of Equatorial Guinea (U.S. Department of State 2002). Nevertheless, if the figures are to be believed, economic growth has brought about rapid development of Equatorial Guinea such that it is now one of the richest nations in Africa according to GDP per capita and now rates higher than Gabon in the UNDP Human Development Index for countries in the region (UNDP 2002).

3.4 ECOFAC

The Programme for Conservation and Rational Utilization of Forest Ecosystems in Central Africa, known as ECOFAC, was set up in 1992. This organisation is funded by

the European Union and is involved in the management of protected areas in six countries in the region; Congo, Cameroon, Central African Republic, Equatorial Guinea, Gabon and São Tomé and Príncipe. In Equatorial Guinea, ECOFAC has the responsibility of managing Monte Alén National Park (PNMA). This park originally covered 1400 square kilometres of forest in the central region of Rio Muni. In 1997, the park was extended to include the Monte Mitra region to the south adding a further 600 square kilometres to its total area (ECOFAC 2002). With this addition, approximately 10% of the country now has protected status supported by legislation (Law No. 8/1998 regarding Wildlife, Hunting and Protected Areas, WCMC 2002).

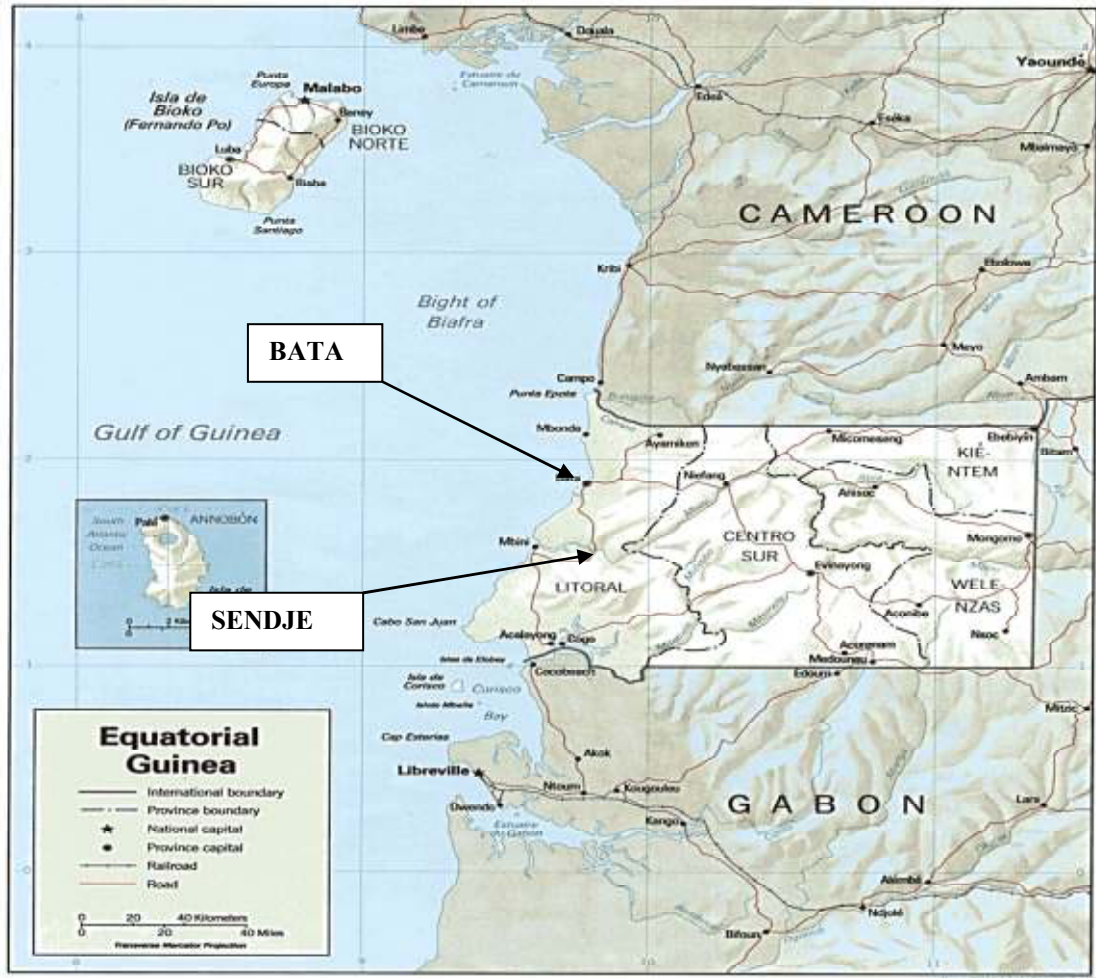
PNMA is an internationally important wildlife refuge, host to at least 233 species of birds, 65 species of reptile, 57 species of amphibian, 62 species of fish and 109 species of mammal including two species of great ape, the chimpanzee (*Pan troglodytes*) and western lowland gorilla (*Gorilla gorilla gorilla*) (Lasso Acala 1995). Indeed, the country as a whole has the third greatest number of species of primates in all of Africa after Cameroon and the Democratic Republic of Congo (Oates 1986, cited in Garcia Yuste 1995). In its management role, ECOFAC has worked to support those communities living on the fringes of the park, employing people to work as guides and guards and establishing 'economatos' that sell cheap, basic goods to the local people (ECOFAC 2002).

3.5 Sendje

The research for this project is centred on the village of Sendje (Figure 1). It is a large village situated in the mid-west region of Rio Muni, within the district of Mbini. It lies a few kilometres outside the western-most boundary of PNMA, a region particularly high in primate diversity (Garcia Yuste 1995). It is strictly called Sendje I to distinguish it from Sendje II, a neighbouring but completely separate village just four kilometres to the north. Sendje lies on the main road linking Bata to the town of Mbini and Cogo in the south of the country. It is therefore well connected to the major urban centres on Rio Muni. Also, Sendje lies at the western most point at which the River Uolo is bridged and thus is an important conduit for traffic heading north or south across the country.

Because of its proximity to Bata, just 42 kilometres away (or an hour's drive) to the north, Sendje has an important trading link with the city.

Figure 1. Map of the Republic of Equatorial Guinea. The village of Sendje and the city of Bata are indicated



4. RESEARCH METHODS

4.1 Preliminary Research and Logistics

Research was carried out in Equatorial Guinea over a two-month period between April 26th and June 27th 2002. Throughout this period I was accompanied by Noelle Kumpel a PhD student from Imperial College and the Institute of Zoology. We collaborated on all aspects of the research but undertook different tasks during the data collection phase, reflecting the different focus of our respective projects.

The majority of the first month was spent in Bata, waiting for documentation to be processed. Here, we kindly had the use of the offices of ECOFAC where we were able to peruse ECOFAC reports and to refine the methodology of our proposed research. We were also introduced to senior representatives from the Ministry of Forests, Fisheries and the Environment whose support and approval was needed to sanction our research.

Whilst in Bata, the opportunity was taken to visit the central market where bushmeat is sold openly on a daily basis. This was undertaken at different times on different days of the week to ascertain, as far as was possible:

- the peak delivery times for bushmeat;
- the means by which the meat is transported to the market;
- the number of vendors involved;
- who delivers, sells and buys the meat (age, sex etc.);
- the volume of bushmeat for sale;
- the species on sale;
- the prices of different species and cuts of meat;
- in what form the meat is sold (whole, cut, live, fresh, smoked, singed);
- what meat-substitutes are for sale in the market;
- the sensitivity of the vendors to inspection of their wares.

On this latter point, our presence in the market did not appear to arouse any suspicion, however to ensure this situation prevailed, the stock-take of what was on offer was necessarily superficial. Nevertheless, this activity was important to familiarize ourselves

with the species on sale, to modify the trader interviews and in its own right to understand the urban market component to the commodity chain.

Also, during the first month of the research-period, the opportunity was taken to spend a week in Monte Alèn National Park (PNMA), courtesy of ECOFAC. This served as a useful introduction to Fang culture, hunting practices, bushmeat dishes, the forest ecosystem, prey species, management of PNMA and attitudes towards both ECOFAC and PNMA. Once again, this information was used to modify the research exercises and interview questions that had been prepared. It also provided an interesting contrast to the situation encountered in Sendje.

Once all of the necessary documentation had been obtained, plans were made to travel from Bata to Sendje. This was arranged through an ex-employee of ECOFAC. He used his contacts to inform the chief of the village (El Presidente de Consejo de Poblado – hereafter the Village President) of our impending visit so that preparations could be made for our arrival. He also accompanied us to Sendje, to smooth our passage at police checkpoints, to introduce us to the appropriate regional authorities in Mbini (including the District Police Commissioner and District Government Representative). This journey was made by bush-taxi on May 28th. On arrival, acquaintance was made with the military representative stationed in the village and also, most importantly, with the village dignitaries. Before his return to Bata, the assistant arranged a meeting with the Village President to help outline our research objectives and timetable.

4.2 Research in Sendje

The research period in Sendje lasted for four weeks, between May 28th and June 25th 2002. The first week was spent conducting familiarization exercises; there was then a lull in proceedings during the annual village fiesta. In the final two weeks, an intensive round of interviews was conducted with households, hunters and traders.

4.2.1 Familiarization exercises

Aim. To establish important general information regarding the:

- layout and household composition of the village;
- geography and exploitation of the land adjacent to the village;
- perception of the national park and relationship with authorities;
- seasonal variations in livelihood activities;
- wealth parameters as perceived by the villagers;
- recent history of the village.

This information was valuable in its own right but also fed into the design of the interviews and served as a reference point for evaluating the validity and reliability of the interview results.

Design. The exercises draw upon tried and tested techniques from what has now become known as Participatory Learning and Action (Chambers 1994; Pretty *et al* 1995). As part of his MSc course the author spent a day exploring the principles behind this method of appraisal and the different techniques that can be used.

Timing. These exercises were conducted soon after our arrival in Sendje and took one week to complete.

Participants. Two research assistants were recruited to assist with coordinating the exercises and recording the results. The Village President was asked to find a small, representative group of approximately five adults from the village to participate as respondents. The pool of people that were ultimately involved was not very representative, being heavily male-biased and dominated by the senior members of the village. On the plus side, however, this did mean that a wealth of information was imparted, from perhaps the most knowledgeable minds in the village. The number of respondents involved at any one time fluctuated from between two and six according to each individual's competing commitments.

Location. All exercises were conducted in a house located in the centre of the village. All participants were sat around a central table in the living room of the house.

Equipment. The respondents were supplied with A3 plain paper, Sellotape, pencils and coloured pens for every exercise.

Implementation. Each exercise was discussed and demonstrated in advance with the research assistants so that they could initiate and guide proceedings. The exercises were only loosely structured to permit as free a flow of ideas as possible.

a) Village map

This map was intended to encompass everything within the boundaries of the village including:

- all roads, tracks and watercourses, indicating where each leads to / from;
- all buildings and other constructions in the village such as houses, kitchens, toilets, schools, meeting places, wells, springs, bars and churches.
- the vegetation cover, use and ownership of land immediately adjacent to the village buildings, e.g. football pitches, plantations, forest and scrub-land.

A tribal chief in the village, who had once worked in a similar capacity for a logging company, was the self-appointed cartographer.

b) Household list

Once the village map had been constructed, the respondents grouped the buildings together into households and assigned each grouping a number. A list was then composed of all of the households, each identified by a number and the name of the head of the household.

c) Regional map

The decision on what scale of map to draw was left to the respondents but they were asked to include all areas in the vicinity of the village that are utilized by the villagers or that impinge in some way on the life of the village. Thus the map was heavily distorted. Features requested included water courses, settlements, relief, roads, hunting paths, hunting camp, national park boundaries, land use and vegetation cover. Discussion ensued as to the changing patterns of land use in different regions shown on the map, in particular where hunting and logging activities occurred and continue now.

d) Seasonal calendar

It had been established that people in the village understood the concept of months, so this was how the year was sub-divided for the purposes of this exercise. Matrices were drawn onto A3 plain paper, with the names of the months written as headings to the columns. The first seasonal parameter dealt with was rainfall, to serve as a reminder of when the dry and wet seasons began and ended. Once the group had reached a consensus, the information was entered into the first row of the matrix. There followed a discussion of all of the major livelihood activities carried out in the village. These were listed in the first column of the matrix and any seasonal variation in the intensity or nature of the activity in a 'normal' year was indicated. In addition, the respondents listed a number of major crops and forest products and recorded on the matrix when planting and harvesting takes place.

e) Wealth-ranking

An attempt was made to establish the key indicators of wealth as perceived by the villagers and then to use this information to subdivide the households into groups based on wealth. This would then provide a basis upon which a representative sample of households could be chosen for interview. A discussion ensued amongst the respondents as to what possessions, titles or positions were important indicators of wealth. This did yield useful anecdotal information, however the group did not feel it was possible to judge the relative importance of these different parameters and felt it was too simplistic and potentially misleading to try to rank the households based on this information, or indeed subjectively.

f) Village history

The group discussed the timing and nature of any significant events they could recall between the present day and the foundation of the village some 50 years ago. The original intention was to record all of this information on a 'time-line' drawn on to paper. However, given the volume of information this yielded and the inability of the group to note down key points quickly it was more effective to let the group discuss matters freely and for the researchers to make their own notes, interrupting to have points clarified as and when required.

4.2.2 Household interviews

Preparation and modification. Provisional interview questions had been devised prior to departure to Equatorial Guinea. These questions underwent a series of revisions based on information gleaned in Bata, in Monte Alèn National Park and once again in Sendje, following the familiarization exercises. In particular, the lists of activities and foods were changed to reflect what is actually done or eaten in the village rather than what we had thought might have been the case. In addition, some of the questions were scrapped if it was made clear that there was no possible variation in the response.

The presence of the fiesta during the research period precipitated a major change in the perspective of the interview. To have asked (as originally planned) the respondents to recall what they had done and eaten in the days preceding the interview would have given a highly distorted impression of village life. This is because the activities and diets of individuals in the days leading up to, during and just after the event were atypical. For example, many of the women devoted more time to preparing food and making costumes and decorations, the men spent more time hunting or fishing, domestic animals were slaughtered, everybody spent a lot of money and the village population swelled. Therefore the interview questions (for household, hunter and trader interviews) had to be altered so that the responses described ‘normal’ or typical behaviour.

Before carrying out the first interview, a day was spent with the assistants and the Village President discussing how the interview should be conducted and further modifications were made based on their input. Trial interviews were then conducted with two different households. These highlighted a number of deficiencies in both the delivery and content of the interview necessitating further revisions. In particular, it was clear that having more than one research assistant present was more of a hindrance than a help. Also, the interview in its current form was far too long and required major excisions. The rationale for removing certain sections of the interview was as follows:

- 1) Deciphering exactly how the members of a household were related to each other proved to be very complicated and misleading and stalled the interview. In the final version of the interview, the position of each member in the household was noted

down but not questioned or pursued further.

- 2) Understanding the current financial status of a household, in terms of capital and income also proved to be an intractable problem since most people do not have a regular income and what money or capital they do acquire derives from a multitude of sources. This point was made clear during the wealth-ranking exercise. To try to establish the wealth of a household based on incomplete data would have been misleading. Nevertheless, a list was made of any significant items owned by the household that were observed or divulged during the interview.
- 3) It was clear from the outset that those issues of primary interest - hunting and the consumption of bushmeat - were not as sensitive as envisaged. It was therefore less important to dilute these areas of inquiry within a much broader framework. Consequently it was felt acceptable to remove non-meat/fish items from the already lengthy list of foods.

The final version of the interview (Appendix 1) was designed to yield the following information about the household:

- basic details regarding the composition of the household, ethnicity and duration of residence in Sendje;
- what the household currently owns in terms of livestock, agricultural land and property;
- the livelihood activities each member of the household carries out and how regularly;
- to what extent these activities serve as a source of income, in terms of the proportion of produce that is sold;
- the frequency with which the household eats different sorts of meat, from a choice of all of the different kinds of domestic meat, fish and bushmeat available to the households in Sendje;
- the means by which the household acquires the different kinds of meat, how expensive they are perceived to be and which they prefer to eat;
- why it is important to eat meat and whether there are other types of food that confer the same benefit to the consumer;

- if there are any differences in patterns of meat consumption between different members of the household;
- the reasons why certain kinds of meat are not eaten by the household (or a subset of the household).

Participants. I conducted the interviews with the help of a research assistant. The research assistant introduced me at the beginning of the interview and explained the purpose of the interview. The research assistant conducted the majority of the interview in both Spanish and Fang, whilst I recorded the responses and interrupted to have points clarified or expanded. Any members of the household who were available were invited to participate in the interview. However, in over half of the interviews (54%) there was only one respondent, who in most cases (86%) was the head of the household.

Equipment. For the purposes of clarity, and to involve the respondents actively in the proceedings, the interview was made as visual and interactive as possible. Cards were produced with the names of different activities and different foods written on them. Much of the interview involved sorting these cards into piles by placing them on the most appropriate space drawn out on a large sheet of plain paper. Sheets with the questions and instructions written on them were also supplied to ensure the respondents were clear as to what the different piles represented for a particular question. This simple system was explained and demonstrated at the beginning and then used throughout the interview.

Location. All of the interviews were conducted in the home of the household being interviewed. The majority of interviews took place in the living room of the main house. Other buildings owned by the household were also used including the open-air talking house or kitchen, particularly if the interview was with a female head of household or wife of the male head of household. In all locations, the participants sat around a table or raised surface, in view and in reach of the sheets and cards being used as visual aids in the interview.

Timing. The interviews were carried out over a period of 16 days between June 8th and June 23rd. The majority of interviews were conducted in the afternoon when there were

more people available, having returned from the morning's work in the fields or the forest. The first two practice interviews lasted for more than two hours. Subsequent interviews were much shorter (shortest = 18 minutes, longest = 76 minutes, mean \pm SD = 43 ± 14 minutes).

Implementation. The village mapping exercise identified 63 households in the village, including the school and the military post. The aim was to interview as many households as possible in the time available. This removed the need to devise a method of selecting a representative sample of households. This would have been problematic for theoretical and practical reasons. It was not possible, for example, to choose a sample based on wealth in the light of the results of the wealth-ranking exercise. Equally, a random sampling method would have proved unworkable given time constraints since the interviews had to be scheduled according to which households were available to talk to at any given time.

In total, 41 households were interviewed. The households were consulted in advance, to request permission for an interview and to organise a mutually convenient time to conduct the interview. No household declined a request for an interview and all volunteered their time for free; no payment was offered or given (Fa *et al* 2002b). The location of each household that had been interviewed was recorded on the village map to check that households from all regions of the village were included in the survey (Appendix 4). There was, however, no evidence that the village was partitioned into distinct regions along ethnic lines, or indeed any other relevant parameter (Mba Mba 1998).

4.2.3 Hunter interviews

Rationale. It was clear from the familiarization exercises that hunting was not a particularly sensitive issue and that people were happy to discuss aspects of hunting. The hunter interview was therefore designed to promote a frank and open discussion about hunting (Appendix 2). The principal components to the interview are described below.

At the very beginning of the interview, the hunting background of the respondent was established and how regularly he currently hunts relative to other activities. Two of these questions are identical to questions in the household interview, thus providing a useful check on the consistency of the responses.

Hunting behaviour was then discussed in terms of the:

- methods used;
- regularity of hunting trips;
- hunting locations;
- diurnal / nocturnal nature of the activity;
- size of hunting parties;
- rationale for hunting;
- frequency with which different prey are caught;
- preferences / targetting of different species;
- seasonality in hunting success;
- perceptions of any changes in prey abundance over time;
- proportion of different prey items sold and to whom;
- price and source of the equipment used.

Participants. The hunter interviews were conducted by Noelle Kumpel with the help of a research assistant. Potential respondents, villagers who hunt on a regular basis, were identified from the household interviews. Only one respondent was a woman and the majority (14/19) were the head of their household.

Equipment. A number of different visual aids were used to encourage the respondent to be actively involved in the interview and to make it easier for the interviewer to record the responses:

- Activities cards, identical to those used in the household interviews, were used so that the respondent could show how often he/she does each activity.
- A simplified copy of the area map was drawn and used in the interview so that the respondent could indicate where he hunts.
- Cards with different possible reasons for hunting were produced. These were to provide some ideas for the respondent to think about beyond the likely obvious or

spontaneous answers such as ‘for food’ or ‘for money’.

- A set of laminated cards were produced prior to travelling to Equatorial Guinea. These showed pictures of the different animals we expected the hunters to encounter based on previously recorded off-take data from hunters operating out of Sendje (Fa and Garcia Yuste 2001). These were to help the respondent to clarify what species he hunts and to avoid any confusion over names (the names of the animals, in Spanish and Fang, were written on the back of the cards). In amongst the set of cards were a number of pictures of species not known to be found in Equatorial Guinea; these were put in to check the respondent’s ability to discriminate between the different species.

Location. The majority of hunter interviews took place in the home of the respondent (16/19), seated around a table so that the respondent could participate actively in proceedings.

Timing. Nineteen interviews were conducted over a period of 11 days (June 12th to June 22nd). Each interview lasted for approximately 45 minutes.

4.2.4 Trader interviews

Rationale. It was evident from talking to people in Bata that Sendje was an important source of bushmeat to the central market there. We had observed women arriving at the market in the morning, in taxis laden with animals that were off-loaded and sold to the vendors (also women) who owned stalls selling bushmeat. Once in Sendje, we were introduced to one of these traders who regularly visits Sendje from Bata to pick up bushmeat. She agreed to be interviewed, as did a male resident of the village who also operates as a trader of sorts.

The interview (Appendix 3) was designed to yield sufficient information to be able to describe and understand the role of different stakeholders and the dynamics of the bushmeat commodity chain. In particular:

- what products, in addition to bushmeat, are traded;

- the temporal pattern of trading;
- which animals are traded;
- the prices paid for purchasing and selling different animals;
- the trading relationship with hunters and vendors;
- the means of transport employed;
- the nature of any conflict with authorities.

Participants. Two interviews were conducted by Noelle Kumpel and a research assistant. The first was with the female trader from Bata and the second was with the male trader from Sendje.

Equipment. The animal picture cards used in the hunter interviews were used to establish the identity of species being discussed and ensure that none were omitted.

Location. The first interview took place in the house of the Village President (where the trader was waiting for hunters to return from the forest) and the second took place in the house of the trader.

Timing. The interviews took place on June 13th and June 15th (respectively).

5. RESULTS

To understand the role of hunting in the village it is necessary to appreciate the context in which it occurs. Initially, then, a brief description is given of life in Sendje: a history of the village, the situation of the village, the inhabitants, the living costs, the livelihood activities and the foods consumed. There follows a detailed description of hunting and the fate of the bushmeat that this activity yields. The probable impact of hunting on the sustainability of the prey populations is then discussed and finally an examination is made of the rationale for hunting given the alternative sources of income and food available.

5.1 Village Life in Sendje

5.1.1 History

Sendje was officially founded in 1953. After autonomy in 1963, the government ordered the resettlement of rural people from the forests to the roads. This was the reason given by half of the households in the sample for how they came to live in Sendje. Unsurprisingly therefore, the mean duration of residence of the households interviewed was nearly 40 years (mean \pm SD = 38.3 \pm 16.8; median = 34; range = 5-77 years). Other, pertinent reasons for moving to Sendje were, ‘to work for a logging company’ (four responses) and ‘damage from animals to crops in the forest’.

Two Spanish logging companies have operated in the area during the lifetime of the inhabitants. They developed the transport infrastructure in the area and provided employment to many of the men in the village and to immigrant workers who settled in the village. The most significant construction was the logging road that bisects the village from east to west (Appendix 4). Sawn logs were conveyed along this road from concessions in the east of Sendje to the river to the west where the logs were floated down the river to Mbini for export (Appendix 5). This road, now overgrown and impassable to vehicular traffic, is the main route used by villagers into the forest.

In 1987 the bridge at the northern limit of Sendje collapsed preventing vehicles from crossing the river (Appendix 4). The river could only be crossed by foot, severely

restricting the flow of people and goods between Sendje and Bata. In 1993, a Lebanese logging company rebuilt the bridge and logged a concession to the north-west of Sendje. Logs were transported out to the main road and driven to the port in Bata. The company remained in Sendje for only two years before closing down its operations. Thus, the only employer left in the area now is a French construction company, based in Sendje II, the next village along the Bata-road, just four kilometres away.

The most notable development in recent years has been the extension of Monte Alèn National Park to include the Monte Mitra region, encompassing much of the forest to the east of Sendje. Whilst this was actually designated back in 1997 (ECOFAC 2002), the respondents (including the Village President) only appeared to be aware of the presence of a national park on their doorstep since the construction of an ECOFAC camp at the park boundary a matter of months ago (Appendix 5). Furthermore, there was some debate as to the exact location of this park boundary.

5.1.2 Inhabitants

The 41 households that were interviewed accounted for 288 people. This figure does not include those relatives, originally from Sendje, who currently live elsewhere but does include children who go to school in Bata where they live during term-time and return to Sendje during the school holidays (follows Mba Mba 1998). Since there were 61 households recorded in the village-mapping exercise (discounting the school and military post), a reasonable estimate of the total population resident in Sendje is 428 ($288 * [61 \div 41]$). There was however a wide variation in the size of an individual household (mean \pm SD = 7.0 ± 4.9 ; mode = 3; median = 7; range = 1-25 people) so this estimate may be misleading.

There is neither a significant departure from a sex ratio of unity within the sample ($\chi^2 = 0.39$, df = 1, Yates' Correction, P = 0.53, NS), nor a significant difference between the mean ages of the male and female populations ($z = 0.74$, df = 256, 2-tailed P = 0.46, NS). Every household had a nominal head, almost always male apart from in three households where the husband had died and the widow had become the household-head in the absence of any sons. All of the residents are of the same ethnic group, Fang, but they belong to different tribes. All members of a family belong to the same tribe since

the women take on the tribe of their husband. Eight different tribes were represented in Sendje, the two most dominant being Yenvam and Yevein, representing 63% of all households.

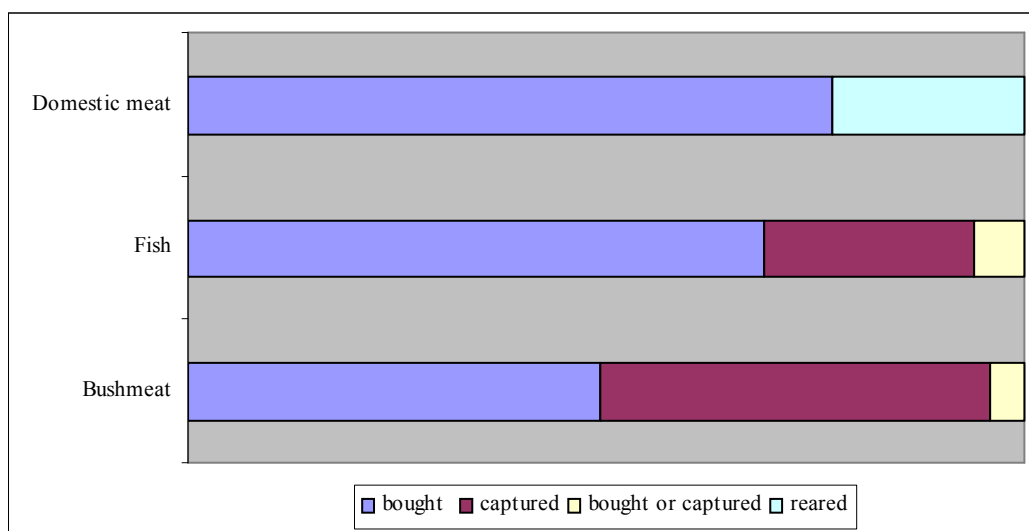
5.1.3 Living costs

Intra-community relationships were very close. Resolving how individuals were related to each other was such a problem partly because of the fact that almost everybody was related to everybody else to a lesser or greater extent! In spite of this, cash was the currency of exchange particularly with regards to transactions of goods between individuals. Indeed, less than 1% of foods (bushmeat, domestic meat or fish) were obtained by barter or received as a gift. Money is thus in everyday usage and is required simply to meet subsistence needs. These include:

- **Houses.** Almost all houses are constructed of wood. Each plank of wood costs about 450 CFA francs (\$0.65). The better houses have concrete floors with either corrugated iron (rather than palm frond) roofs. The latter cost 2500 CFA francs (\$3.60) per piece. Obviously the total cost of the house depends on its size but it may cost as much as 100,000 CFA francs (\$140.00).
- **School.** To attend school in Sendje is virtually free, costing 700 CFA francs (\$1.00) to enroll each year. Attending school in Bata is significantly more expensive. Annual enrolment costs approximately 25,000 CFA francs (\$36.00). In addition money is needed to pay for books and equipment, uniform and possibly maintenance costs.
- **Food.** The majority of people meet most of their plant-food needs from their fields or the forest. Of the different sources of animal protein available, a significant proportion of bushmeat, domestic meat and fish is bought (Figure 2).
- **Basic commodities.** This includes items such as soap, batteries, petrol, vegetable oil, salt, bottled drinks, medicines and cigarettes (Cayuela Serrano 1998)
- **Tools.** Machetes are vitally important multi-purpose tools needed for fishing, hunting, cultivation and collecting firewood. Fishing and hunting also require specialist equipment such as fishing line, nets, fish-traps, wire and cartridges.
- **Travel.** The most common journey made is to Bata to buy provisions, sell produce, visit relatives or go to school (at the beginning of term). It costs 1000 CFA francs (\$1.40) per passenger one-way by bush-taxi (more if a lot of baggage is taken). It

costs 3000 CFA francs (\$4.30) to take a taxi south to Cogo and at least 10,000 CFA francs (\$14.00) to Libreville, not including bribes!

Figure 2. The means by which households obtain the bushmeat, fish and domestic meat that they consume. The proportions for each different type of bushmeat, domestic meat and fish consumed (list given in Appendix 1) are combined and no account is taken of the relative quantities of each type consumed.



The list of wealth-indicators compiled by the respondents is largely a reflection of a household's ability to bear specific costs; of supporting dependants and acquiring capital. The indicators were:

- The number of people in a household.
- The number of wives of the household-head (maximum = 3; mode = 1).
- Number of household members in employment living either in Sendje or elsewhere (commonly Bata, Malabo or Libreville).
- The number of children educated in Bata.
- The number, size and condition of buildings owned by the household (Table 2).
- The number and kind of livestock owned (Table 2). All livestock, particularly goats are valuable commodities (Appendix 6)
- Car ownership. Only one household in the village owned a car.
- Other significant possessions. Popular items included stereos, 3-piece sofa suites and less commonly, shotguns and chainsaws.

- The area of land cultivated by the household. This land is not strictly owned; permission to clear and cultivate it is granted by the Village President. The number of separate plots of land was recorded in the household interviews (Table 2). It was not, however, possible to measure the size of every plot. A previous study of villages on the boundary of the Monte Alèn National Park (PNMA) estimated that the mean size of an agricultural plot was 0.6 hectares but size was very variable (range: 0.02-9.60ha) (Garcia Yuste 1995). Plot-number is therefore not a reliable indicator of the area of land under cultivation.

Table 2. A summary of the properties owned by households in the household interview sample (n = 41).

Property	Details	Median	Mode	Range	Sum
Living quarters	Bedrooms + living room	1	1	1-5	68
Kitchens	Single-room simple construction	1	1	1-4	56
Bars	Variable size selling alcoholic drinks and basic commodities	0	0	0-2	8
Talking houses	Open air structures with benches and a table	0	0	0-1	5
Livestock	Chickens	5	0	0-20	252
	Ducks	0	0	0-10	75
	Goats	0	0	0-3	6
	Pigs	0	0	0-1	1
	Dogs	0	0	0-1	4
	Cats	0	0	0-3	25
Agricultural plots (all types)		2	2	1-5	95

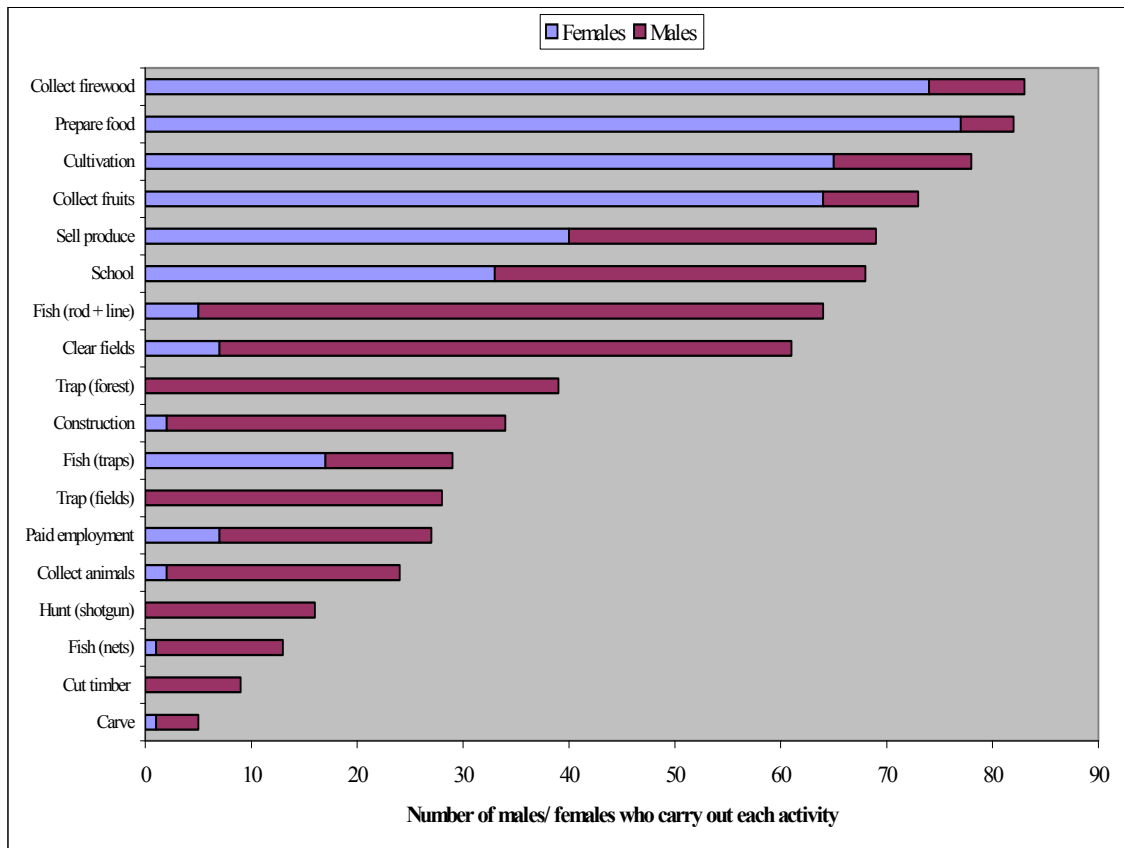
5.1.4 Livelihood activities

As illustrated in Figure 3, there is a clear division of labour along gender lines with respect to almost all major livelihood activities. In very small households where there might only be one physically fit person, this division was less clearly defined.

Women

Daily activities for the majority of women relate to food. In the fields, the women are usually responsible for planting, tending and harvesting crops. This is to some extent a seasonal activity but since a range of crops is typically grown, there is always agricultural work to be done. It is also the women who venture into the forest to collect plants and fruits and to cut firewood. Back at home, chores include washing clothes and dishes, collecting water, preparing food and looking after the children. Some women (15%, aged 18 and over) also go fishing, albeit rarely (typically less than once a month). The majority fish with traps; basket-like constructions made from strips of bamboo that are baited and are used to catch freshwater shrimp and crabs.

Figure 3. The livelihood activities carried out by males and females in the village.



Men

Unlike the women, who have a number of activities to carry out on a daily basis, the pattern of activity of the men is less consistent. The men make an irregular contribution

to agriculture being required to clear the fields prior to re-planting. This is usually done twice a year. After 3-5 years the field is left fallow and a new one is cleared, requiring additional effort to cut down trees. The men may also maintain a supply of palm wine, extracted from oil palms that have been felled and stripped. Any repair-work to houses or construction of new buildings is carried out by the men. The materials needed for this (principally timber) are bought or gathered from the forest. Fishing is predominantly a male activity and includes fishing with traps, nets or rod-and-line. The latter method is by far the most popular; an activity that 55% of males, aged 10 or over engage in (Figure 2). For most it is an occasional activity; only 24% of rod-and-line fishers go fishing at least once a week.

Children

From a very young age, all children have the opportunity to go to school. There is infant school for 4-5 year-olds conducted in the village meeting house (Appendix 4) and a main school for 6-15 year-olds. The pupils attend either morning or afternoon school, Monday to Friday. A significant number of the older children attend school in Bata (37% of boys and 29% of girls in the 10-19 age group) where they live during term time, usually with a relative. This is the only way for the children to gain more than just a rudimentary education. These children return to Sendje during the holidays, the timings of which closely match those commonly found in schools in the UK.

In their spare time outside of school the children can make an important contribution to livelihood activities. Typically this involves helping the women with household chores. Also, in the dry season, when they have most free time (school holidays) and when the conditions are most favourable, some of the children go fishing. A common method, used only by the children, is to dam the streams, bail out the water and collect the fish. A majority of the boys (56%, aged 10-19) also fish with a rod and line, mostly during the summer months.

5.1.5 Food

Most people in the village eat twice a day. Typically all members of a household eat the same meals, unless a food is taboo for a particular group (Table 7) although not necessarily together; the women sometimes eat together in the kitchen whilst the men

eat together in the house.

The main source of food is agriculture. The common staples, all-important sources of carbohydrate are cassava (*Manihot utilissima*), malanga (*Xanthosoma violaceum*) and plantain (*Musa paridisiaca*) (Mba Mba 1998). Other plant foods are collected from the forest such as ‘chocolate’ (*Irvingia gabonensis*). Sources of protein include fish, domestic meats and bushmeats plus peanuts and eggs to a limited extent (the latter being more valuable as potential chickens).

The majority of households (85%) currently own livestock. The number of livestock, owned by any household (Table 2) is, however, insufficient to provide a regular source of meat. Livestock, particularly the most valuable animals such as goats (Appendix 6) tend only to be slaughtered for special occasions such as weddings or fiestas; most domestic meat is bought (Figure 2). Cats and dogs are kept but not eaten; the former for controlling the mouse population and the latter, rare in the village, for guarding houses or occasionally for hunting.

Certain foods, such as tinned meats and fish are imported into the village and sold in the bars. Any frozen fish or chicken has to be bought from Bata or the ‘economato’ in Sendje II. This shop is located on the grounds of a camp for employees of a construction company and is the only place nearby with refrigeration facilities.

5.2 Description of Hunting

A comprehensive picture of hunting behaviour was built up from the information obtained in the familiarization exercises, household interviews, hunter interviews, from informal conversations with hunters and observation of hunting activities. Below, the characteristics of the hunters are first described followed by an analysis of the hunting methods employed.

5.2.1 The hunters

Hunting is almost exclusively a male activity (Figure 3). Only one woman was recorded as a hunter (in the hunter interview sample); she traps around her fields and used to accompany her husband trapping in the forest. Of the 124 males whose activities were recorded, 49 hunt, i.e. they trap and/or shoot and a further two individuals just ‘collect animals’ (Figure 4). These hunters are distributed amongst 34 of the 41 households interviewed. A household therefore commonly contains just one hunter (Figure 5).

Figure 4. The proportion of males (all age groups) in the village who hunt and the different hunting methods used

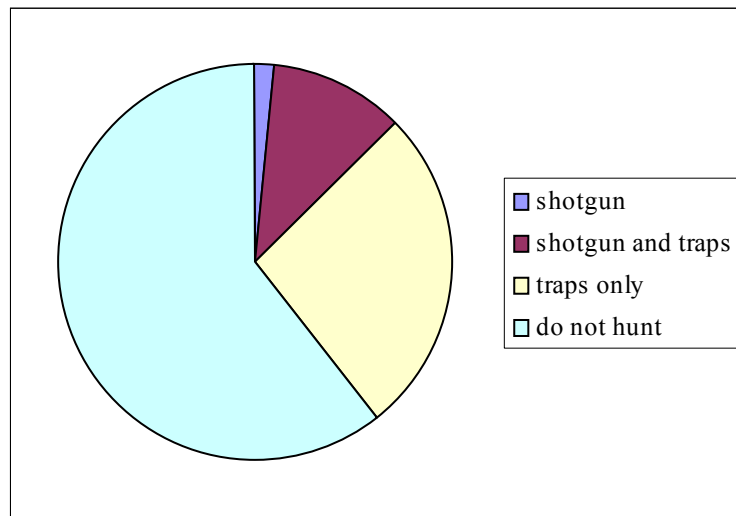
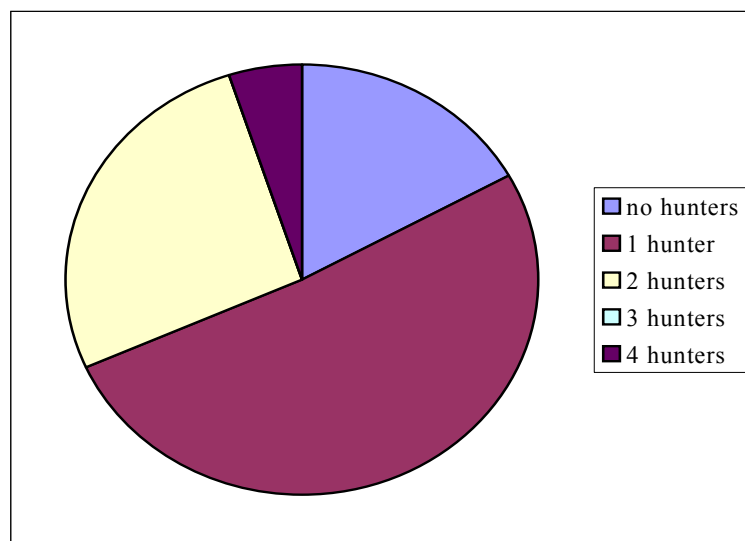
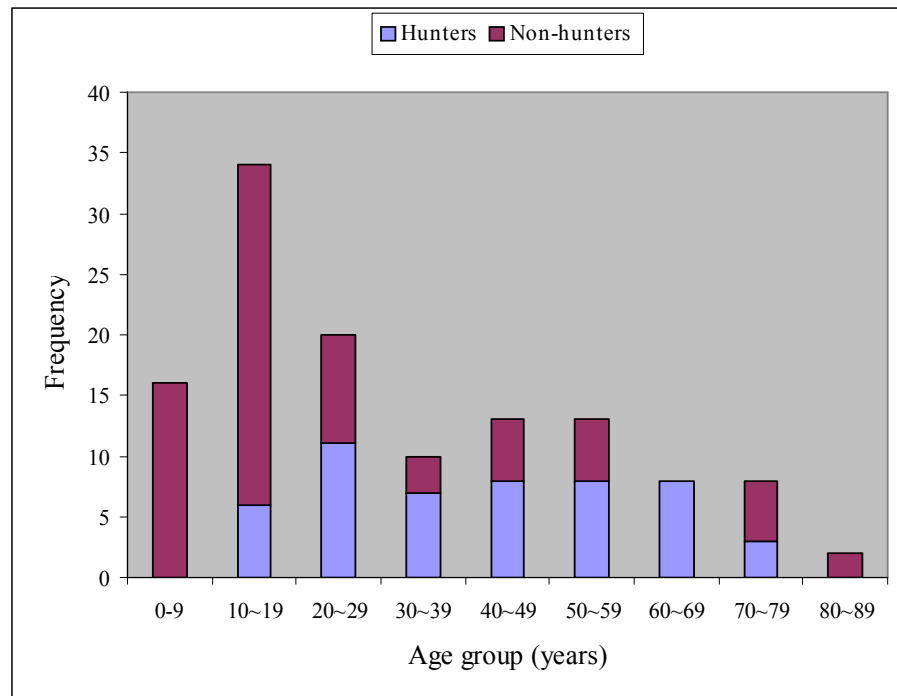


Figure 5. The proportion of households with different numbers of hunters.



The percentage of males who hunt increases from 40% to 61% if all males younger than age 20 are discounted; an indication of how very few young boys participate in hunting (Figure 6). The youngest hunter is a boy aged 13 who occasionally traps around his parents' fields. Only older boys are allowed into the forest to trap, the youngest is aged 16. Older still is the youngest man who hunts with a shotgun, aged 24. This pattern may be explained in terms of the danger posed by hunting and the opportunity cost for a teenager to be hunting - he would miss school. As previously explained, a third of the boys (10-19 age group) are away at school in Bata for much of the year only returning to Sendje for their vacations, during which time a greater proportion go fishing (56%) rather than hunting (18%).

Figure 6. The age structure of the males in the household sample (n=124), showing the proportion of males who hunt.



The mean age of the hunters is 42. This value does not change significantly if calculated separately for shotgun hunting (n = 16), trapping in the forest (n = 39) or trapping in the fields (n = 28) (ANOVA, $F_{3,101} = 0.153$, $P = 0.93$, NS). It is also not significantly different from the mean age of the male population of 'hunting age' (aged 13 or over) in the interview sample ($z = 1.21$, $df = 148$, 2-tailed $P = 0.22$, NS). The hunters are not distributed proportionally across all age groups ($\chi^2 = 24.3$, $df = 7$, $P < 0.01$) although

there is no significant departure from proportionality if all males under the age of 20 are removed from the analysis ($\chi^2 = 4.2$, $df = 5$, $P = 0.52$, NS). The greatest number of hunters is found in the 20-29 age group, but the highest proportion of hunters per age group is found in the 60-69 age group, where all of the men hunt to some extent (Figure 6). The majority of hunters interviewed said that they had started hunting many years ago (mean = 21 years; range = 1-40 years) when they were teenagers. Since that time, hunting had been an activity they had reverted to in between periods of employment. The level of hunting activity was not dictated by the seasons.

5.2.2 Hunting methods

The two main methods of hunting are shooting and trapping, the latter being most commonly used (Figure 4). Two hunters (4%) only hunt with a shotgun, the rest use shotguns and traps (29%) or just traps (67%).

a) Trapping

A mixture of different sorts of traps is used, depending on the skill and experience of the trapper and the type of prey being targeted. The trap most commonly used, called 'nga' (Table 3), consists of a wire noose connected to a bent-over sapling under tension. If an animal steps into the noose, the mechanism is released and the animal is caught, usually by one of its limbs. The reason it is so widely used is that it is quick and simple to construct (up to 15 can be set in one day) and is very versatile. It is able to be set, strategically, in the path of the target-prey and can be made bigger or smaller to catch different sized prey. The 'ebeneñong' trap works on the same principle but the noose is positioned vertically to trap the prey round its neck. It is also very common but is more difficult to set up than the 'nga' and is only able to catch the smaller prey; rodents, reptiles and occasionally small antelopes (Meñana Nsang 1998). There are two, similar, types of arboreal traps called 'nbong' and 'abengua'; both neck snares designed to trap arboreal primates. A wire noose is attached to a bent-over pole and placed along a horizontal branch in the path of the monkey. 'Aberetong' is a hand snare, baited with food (usually a lump of cassava, *Manihot utilissima*) and designed to catch primates, particularly the less arboreal species such as mandrills (*Mandrillus sphinx*).

All of these methods use metal wire in their construction. Wire can be bought in Bata or from one of the bars in the village or from the traders. It costs 300 CFA francs (\$0.50) per metre, from which two traps can be made. The number of traps set by a single hunter is highly variable (mean \pm SD = 95.6 \pm 53.2; range = 6-200) (Table 3) representing a maximum capital investment (i.e. for 200 traps) of approximately 30,000 CFA francs (\$43.00). Note, though, that an individual trap might need replacing every few weeks either because it has rusted or been damaged by a captured animal.

There is also one type of trap, rarely used, called ‘ekuru’ that does not require wire, that is used to capture rodents, pangolins and palm civets (*Nandinia binotata*). It consists of a log, laid on the ground, propped up at one end. When the prey crawls under the log to retrieve the bait, the mechanism is released and the log drops onto the animal crushing it. Prior to setting any trap (or indeed using a shotgun) the custom amongst hunters is to wash their hands with a mixture of dung of a wild animal (usually that of an antelope or pig) leaves and water, apparently in order to improve their chances of success.

Table 3. Characteristics of trapping. The data is taken from the hunter interviews and reveals whether the hunter traps in the forest, fields or both, plus the number of traps maintained at any one time and the types of trap used.

Trapper	Location	No. of traps	Traps used
1	forest + fields	80	nga
2	forest + fields	40-50	nga, nbong
3	forest + fields	120	nga, nbong, ebeneñong
4	fields	>100	nga, ebeneñong (most),
5	forest	200	ebeneñong
6	forest + fields	25	nga, nbong, ebeneñong, abengua
7	forest	100	nga
8	fields	100	nga (most), ebeneñong
9	forest	100-200	nga, ebeneñong, aberetong,
10	forest + fields	40-70	nga (most), ebeneñong
11	forest	100	nga, ebeneñong, abenqua (few)
12	forest + fields	>200	nga (most), ebeneñong, abenqua
13	forest	100	nga (most), ebeneñong, abenqua
14	forest	50-120	nga
15	forest + fields	50	nga, ebeneñong, abenqua
16	fields	6	ebeneñong
17	forest	100-120	nga, ebeneñong

If the trapped animal is not dead when the trap is inspected, it may be kept alive to keep it fresh for longer. This is only possible for smaller, less dangerous animals, such as blue duikers (*Cephalophus monticola*) that can be safely trussed up and carried. Otherwise the animal is killed by a blow to the head with a machete or stick, or shot with a shotgun or bow and arrow (only one hunter used this method) if it is too dangerous to approach. Since very few hunters have shotguns they may need to return to the village to recruit helpers. Assistance might also be needed if a large animal such as a buffalo (*Syncerus caffer*), sitatunga (*Tragelaphus spekei*) or giant hog (*Hylochoerus meinertzhageni*) is trapped, to help carry the carcass back to the village.

There are two basic locations where trapping takes place, in the fields or in the forest. Traps set in the fields are typically positioned around the perimeter of the field so as not to interfere with cultivation but also to reduce the number of animals entering and eating the crops in the absence of any fencing. The greatest number of traps set in the fields by any one trapper in the survey sample was 100 around 3 fields. The capture rate is, reportedly, extremely variable, between 0-10 animals per week per trap-line. The traps are usually checked every day or every couple of days, occasionally by the women who do most of the work in the fields (Figure 3). All of the households interviewed cultivated one or more plots of land where they could trap. However, more trapping takes place in the forest rather than in the fields both in terms of the number of trappers (39 compared to 28) and the frequency with which trapping, as an activity, is carried out ($\chi^2 = 34.0$, $df = 2$, $P < 0.001$).

The favoured location for trappers (and for shotgun-hunters) is the forest to the east of the village, continuous with the western edge of the forest in the Monte Mitra region of Monte Alèn National Park (Appendix 5). Here, the prey is reported to be more abundant and diverse, including larger animals. The main route into this region of forest follows the old logging road that crosses the village from east to west. It only takes about three hours by foot to reach the park boundary along this path. Traps set along this initial section of the path can be checked within a day; thus half of the trappers interviewed do not trap further into the forest than this point. Other trappers, however, wade across the river (*pers. obs.*) into the national park and trap up to 30 km away from the village, usually setting their trap-lines close to one of the many hunting camps (Appendix 5).

These camps are the remnants of long-abandoned settlements that now provide shelter for the hunters and a place to store and smoke meat. There appeared to be neither rivalry between hunters nor competition over hunting territory. They often accompany each other into the forest and stay at the same hunting camps, but when it comes to actual hunting, two-thirds of hunters stated that they hunt alone.

Once inside the park, the paths deteriorate and the terrain becomes more precipitous, making the journey to and from the hunting camps very arduous. Because of the distances involved, the trappers often spend all week, Monday to Friday in the forest or make multiple trips, spending just one night in the forest at a time. Whilst in the forest, a trapper, even if he is away from the village for two weeks, will not necessarily eat any of his catch, particularly if he has caught commercially valuable species (Appendix 6; Appendix 7). He subsists instead on other food, usually cassava (*Manihot utilissima*) carried into the forest and fish caught from one of the many rivers traversing the area (Appendix 5). The bushmeat has to be smoked to preserve it if it is not taken back to the village within hours of its capture but since smoked meat is less desirable it fetches a lower price (Appendix 6).

b) Hunting with guns

The only guns used by hunters are shotguns. These are capable of bringing down all types of prey except for elephants (*Loxodonta africana*). Those trappers in possession of a shotgun often take it with them to kill any large prey caught in the traps or to shoot any monkeys encountered along the way. On other occasions, the hunter makes specific hunting trips, usually day-trips, just to hunt with a shotgun. Of those hunters who expressed an opinion, hunting with a shotgun was preferred over trapping because it is much more effective, particularly at capturing monkeys, a valuable prey item, (Appendix 6) and does not necessitate long trips into the forest. Unlike trapping, shotgun hunting may be conducted successfully at night although this is considered to be more dangerous (largely as a result of the perceived threat from elephants) than hunting during the day and more expensive since a torch is needed and there is a greater risk of missing the prey.

Whilst it may be a more efficient method of hunting in terms of time, hunting with a shotgun is nonetheless much more expensive than trapping - prohibitively so for many hunters, who stated that they could not afford to do it. A brand new shotgun costs approximately 140,000 CFA francs (\$200.00) and a second-hand shotgun costs about a third of this price. Consequently there are only four hunters in Sendje who own a shotgun. Two of these owners hire out their shotguns, charging between 5,000 and 10,000 CFA francs (£7.00-\$14.00) a month for this service. One hunter said he hires a shotgun from a friend in a neighbouring village. A slightly more complicated business arrangement exists between one of the hunters and the Village President. The Village President lends the hunter his gun, supplies him with cartridges and the profits are split three-ways: one-third to each of them and the other third to purchase more cartridges. A single cartridge costs 700-750 CFA francs (\$1.00), therefore should a hunter miss too many times or find he has bought faulty cartridges, the profit margin can be very slim unless he shoots something very valuable (Appendix 6).

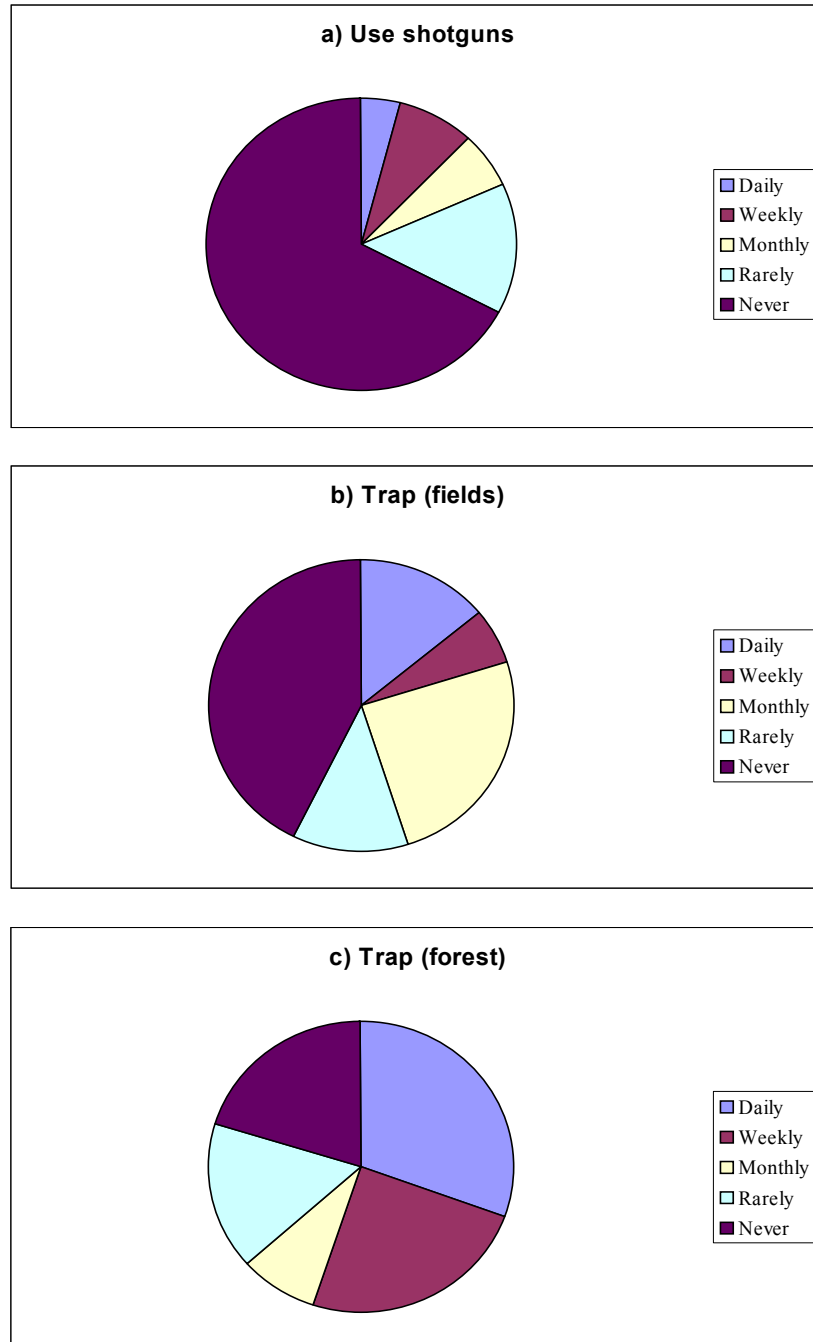
The scarcity of shotguns and the high capital and operating costs of hiring one and buying cartridges explains why few hunters use them exclusively (Figure 4) or use them regularly (Figure 7) compared to trapping in the forests or fields ($\chi^2 = 16.2$, $df = 6$, $P < 0.05$). In addition to the costs, a licence is required to use a shotgun, which must be obtained from the district authorities in Mbini. The hunter, whether he is a resident of the village or an outsider, must then seek permission from the President if he wishes to use a shotgun in the area.

3) Other methods of hunting

Whilst trapping and shooting account for most of the hunting that takes place, other methods are also employed. None of the hunters interviewed used any of these methods exclusively, just occasionally in addition to trapping and/or shooting. Most of these methods are effective in capturing animals that can be approached to within striking distance. Prey animals mentioned included snakes, crocodiles, porcupines, cane rats (*Thryonomys swinderianus*), pangolins, cusimanses (*Crossarchus obscurus*) and duikers. The hunter uses a machete, lance or hand-held noose (for crocodiles) to kill or disable the prey. This type of hunting is most successful at night when the animals are active and in some cases freeze in torchlight (e.g. duikers, Newing 2001). If carried out

during the day, dogs are commonly used to flush out the prey. Other, less dangerous and more sedentary animals can be collected without the need for weapons or tools, such as tortoises and snails. The latter are apparently quite rare in the forest surrounding Sendje, in contrast to the area around Niefang where it is common to see bundles of snails hanging up for sale by the roadside (*pers. obs.*).

Figure 7. The regularity with which hunters (n = 49) hunt with shotguns (a), trap in the fields (b) and trap in the forest (c).



If a village is suffering crop damage or major disturbance from elephants, the village authorities can appeal to the regional authorities to have the elephants destroyed. If approval is given, specialist elephant hunters are supplied with military weaponry (rifles) and employed to shoot the elephants. The proceeds are apparently shared, with the meat going to the village and ivory to the officials. This might explain the fact that 87% of respondents said that they ate elephant meat, albeit rarely (Appendix 9).

Most obscurely, one of the hunters interviewed earns a healthy income from catching grey parrots (*Psittacus erithacus*), a locally abundant species (*pers. obs.*). He is able to capture these parrots, live and uninjured, from their roosts at night. A night's work will yield four or five parrots, which he sells to a specialist trader who visits him about once a month. The trader buys them from him for 10,000 CFA francs (\$14.00) each, and sells them in Bata for 15,000 CFA francs (\$21.00). According to the hunter, these parrots are stowed away on board cargo boats carrying timber bound for the UK!

Lastly, although very few boys or teenagers 'hunt', they are opportunistic collectors of animals they find in and around the village. In particular they use slingshots to capture or kill small birds either to protect the crops, for target practice or for pets (the birds are kept in small wooden cages made by the boys) (*pers. obs.*).

5.3 Description of the Commodity Chain

5.3.1 The traders

There is one principal trader, a 45 year-old woman (hereafter 'Trader A') who buys meat in Sendje and transports it to the urban markets in Bata. She is a resident of Bata unlike the other trader interviewed, a 42 year-old man and resident of Sendje (hereafter 'Trader B'). They operate, to some extent as a partnership, albeit an informal one. Both have worked as traders for a long period of time: Trader A for 10 years and Trader B for 12 years. There are, reportedly, two other female traders from Bata who occasionally visit Sendje to buy meat. They were not seen during the research-period.

5.3.2 Purchase of bushmeat in Sendje

Trader A makes three return journeys between Bata and Sendje each week. She is usually in Sendje to buy meat on Mondays, Wednesdays and Fridays and returns to Bata with the meat, the following morning. She stays the night at the house of one of the hunters. There is, apparently, insufficient meat available to warrant more regular trips and even with the current system both traders often supplement their highly variable bushmeat cargo with purchases of fruits, crops, domestic meats and dried fish to make the business worthwhile. According to Trader A, there is generally less meat available now compared to two years ago.

There is no exclusive relationship between hunters and traders; the traders will buy meat from whoever has meat to sell. The traders do not supply the hunters with credit (for food, wire, cartridges etc.) but usually make a straight purchase for the bushmeat. Typically, there is most bushmeat to buy on a Friday, when a greater number of hunters return from the forest to spend the weekend in the village with their families. Trader B actually treks into the forest with a helper, up to three times a week, to two hunting camps, typically a two-day round-trip, to buy meat from the trappers there. This saves the trappers the hardship of carrying the meat back themselves and since Trader B brings them food and sometimes wire, in part-exchange for meat, they can remain in the forest for longer periods of time (up to two weeks instead of one week). Trader A will visit hunters' houses in search of meat to buy or she waits at the Village President's house, located along the main track into the forest, for the hunters to return with their catch. More than half of the meat that is bought is smoked, particularly on a Monday if the hunters have been out in the forest all weekend. They buy whole animals and parts of animals; the latter are more common when yields are low and the hunters take some of the meat for personal consumption. Parts of animals are more likely to be smoked than fresh. Indeed, Trader A will smoke the meat herself if she cannot get the meat to the market before it goes off, which, for some animals (species not given), occurs within a day. Some live animals are bought; these animals have a longer shelf life if kept alive but the price is no different in the urban market so they are often killed if this makes them easier to handle in transit. Neither trader is selective; he or she buys anything on offer. The hunters are therefore guaranteed a sale as long as a price can be agreed on. There are, however, some species that are more profitable to trade in according to

Trader B such as brush-tailed porcupines (*Atherurus africanus*), giant pangolins (*Smutsia gigantea*) and wild pigs (*Potamochoerus porcus* and *Hylochoerus meinertzhageni*).

Selling meat to traders is not the only way in which bushmeat is exported from the village. Two of the biggest bars in Sendje, both located next to the road, occasionally had animals for sale, either intact or cooked (usually as a stew); popular take-away for passing travellers (*pers. obs.*). This however seemed rather limited compared to the abundance of meat that was seen on sale by the side of the main road between Bata and Niefang. This difference is most likely due to the greater concentration of traffic along this road (*pers. obs.*) enabling the hunters to sell directly to passing consumers (and thereby receiving a higher price?) or to passing traders.

5.3.3 Transportation of bushmeat to Bata

As explained, Trader A makes the journey from Sendje to the market in Bata with bushmeat and other produce, three times a week. Trader B usually sells the meat he collects from the hunters in the forest to Trader A and only makes the journey if he needs to go to Bata to buy provisions or if Trader A is not available to sell meat to. Trader B, then, effectively acts as an intermediary between the hunters in the forest and Trader A; an additional link in the commodity chain.

It is 42 kilometres from Sendje to Bata along a good quality road. The journey takes about an hour and costs 1000 CFA francs (approximately \$1.40) one-way by bush-taxi, the only means of public transport. The traders use any taxi that happens to be passing through Sendje. In addition to the standard passenger charge, the traders have to pay for their cargo. For the larger animals, the trader is charged for each one whilst for the smaller animals, there is price per sack. The prices will depend on the individual taxi-driver and the size of the animals. Trader A sometimes stops mid-transit to pick up bushmeat from another village on route to Bata.

The costs do not stop there. For Trader A, there is a well-established system of gratuities to pay. Firstly, there is a major police checkpoint located 10 kilometres outside of Bata along the road to Sendje. She pays the police here 80,000 CFA francs

(\$115.00) per year in exchange for trouble-free passage. She does however suffer hassle from forest officials at this checkpoint to whom she must pay a small fee per animal every time she passes through. Apparently she is not molested as much as she used to be by these people and they can always be paid off with sufficiently large bribes. Trader B, who makes these trips much less frequently, is also known by the authorities at the check-point and has to hope he is not spotted otherwise he has to pay a significant fee of anywhere between 3000 and 10,000 CFA francs (\$4.00 - \$14.00) depending on the quantity and type of meat he is carrying. Indeed, both traders said they suffered more problems with officials if they transported certain species, including chimpanzees (*Pan troglodytes*), gorillas (*Gorilla gorilla*), pangolins (*Uromanis tetradactyla*, *Phataginus tricuspis* and *Smutsia gigantea*) and crocodiles (mostly *Osteolaemus tetraspis*). In addition, Trader B cited red river hogs (*Potamochoerus porcus*), giant hogs (*Hylochoerus meinertzhageni*), black colobus (*Colobus satanus*), and tortoises (mostly *Kynixis erosa*) as species that attract unwanted attention from officials. Because greater hassle translates into higher bribes, there is a definite disincentive to trade in these species.

Interestingly the gorilla, chimpanzee, black colobus and pangolins all featured on two posters of species it is prohibited to trade in and export, as specified in 'Ley Num. 8 / 1998 regulado de la Fauna Silvestre, Caza y Areas Protegidas (Law No. 8 / 1998 regarding Wildlife, Hunting and Protected Areas). One poster was restricted just to primates and also featured the red-capped mangabey (*Cercocebus torquatus*), Demidoff's galago (*Galagoides demidoff*), elegant needle-clawed galago (*Euoticus elegantulus*), potto (*Perodicticus potto*), De Brazza's monkey (*Cercopithecus neglectus*) and the grey-cheeked mangabey (*Lophocebus albigena*). The other poster featured the elephant (*Loxodonta africana*), leopard (*Panthera pardus*) and hippopotamus (*Hippopotamus amphibius*) in addition to the pangolins. These posters were observed in the regional police headquarters in Mbini and in the home of the Village President. This may provide a basis upon which the officials can extort higher bribes from the traders for these species.

Both traders divulged the prices commanded for certain types of bushmeat at different links in the commodity chain (Table 4). The information provided was conflicting due

in part to the variation in price of the same species of animal according to its size. Furthermore, the figures offered by Trader A suggest that she loses money on certain species once all of the bribes and costs have been factored in! Nevertheless, what the data does show is that the margins for the traders are relatively small. This is perhaps not surprising; with Bata just an hour away, the hunters (or their wives) would presumably sell the meat themselves if the trader made all of the profit.

5.3.4 Sale of bushmeat in Bata Central Market

Trader A sells all of her bushmeat to the women who rent stalls in the central market. The meat is loaded from the taxi onto a small cart and wheeled a short distance to the stalls. Trader A has to pay 10,000 CFA francs (\$14.00) per year to an official in the market plus a fee of 300 CFA francs (\$0.50) every time she brings produce to the market. Quite why she must pay this and to whom was unclear.

Bata is reportedly the focal point for much of the bushmeat trade in Rio Muni. The central market is one of three main markets selling bushmeat in Bata, all supplied, apparently, by different traders from different regions (this could not be substantiated). These markets, however, do not account for all of the bushmeat being sold in the city. According to the traders, some hunters bring the meat they have caught into the city and sell it directly, often to restaurateurs.

From personal observations over a three-week period it was possible to get a general feel for the dynamics of the market. The timing of delivery of bushmeat to the market varied from day-to-day, but was typically between eight o'clock when the stalls and shops opened for business and ten o'clock in the morning. There were typically three (but up to five) concrete stalls, all next door to each other, selling bushmeat. These were surrounded by stalls selling fruits, vegetables, imported meats, fish and non-consumable products. The women running the stalls helped each other to unload and prepare the meat. The quantity, species and condition of the meat on offer varied considerably but was dominated by monkeys and duikers (Appendix 8). In addition to bushmeat, the same stalls also sold live domestic animals such as chickens and pigs (usually slaughtered and divided up before being offered for sale) plus large freshwater shrimp

and catfish. These animals were also brought to the market by the bushmeat traders. Typically most or all of the meat had been sold by early afternoon.

Table 4. A sample of traded species showing the price paid to the hunter, the costs of transport, the bribe (this does not include the annual bribes paid) and the trader's profit. Note that the prices for a particular species vary considerably according to the size of the individual animal.

Species	Purchase price (CFA francs)	Transport cost (CFA francs)	Bribe (CFA francs)	Trader's profit (CFA francs)
Putty-nosed monkey (<i>Cercopithecus nictitans</i>)	5000	500	300	200
Mandrill (<i>Mandrillus sphinx</i>)	15,000	2,500	300	2200
Sitatunga (<i>Tragelaphus spekei</i>)	50,000	5000	3000	2000
Red-river hog (<i>Potamochoerus porcus</i>)	40,000	5,000	5,000	10,000
Giant pangolin (<i>Smutsia gigantea</i>)	30,000	5,000	5,000	5000
Tree pangolin (<i>Phataginus tricuspis</i>)	3,500	250	300	950
Cane rat (<i>Thryonomys swinderianus</i>)	5,000	500	300	200
Giant pouched rat (<i>Cricetomys emini</i>)	500	0	0	500
Brush-tailed porcupine (<i>Atherurus africanus</i>)	5,000	250	300	1,450

5.4 Sustainability of Hunting

There were, apparently, many more (actual number not determined) itinerant commercial hunters operating from Sendje up until a few months ago. Their departure was attributed to two phenomena: the establishment of a camp for ECOFAC guards next to the park boundary (Appendix 5) and increasingly diminishing hunting success. Indeed, every single hunter who offered a response claimed that there were fewer animals left to hunt, particularly close to the village. This claim is corroborated by the

traders who alluded to a reduction in the supply of animals from individual hunters. The extra hunting pressure exerted by these itinerant hunters was suggested as a reason for this decrease in abundance of animals. The problem is exacerbated by a sustained level of hunting by men from the village. The effect of a decline in prey has been to increase hunting effort with hunters venturing further into the forest to hunt and spending longer away from the village.

Trapping was singled out as the method proving to be particularly unproductive at the moment compared to 'before'. In contrast, there are, apparently, plenty of monkeys still in the area for shotgun hunting to be a relatively fruitful activity. The high costs of using a shotgun are more than compensated by the high returns: 3000-5000 CFA francs (\$4.50 - \$7.00) for each monkey (Appendix 6). Due to the high costs involved, the shotgun hunters claim not to shoot certain animals because they are too small. Included within this category are squirrels, prosimians and talapoins (*Miopithecus gouensis*), despite the latter being apparently very abundant near to the village and significant crop-pests (Appendix 7).

The only animal that was reported to be more abundant near to the village, than before, is the elephant (*Loxodonta africana*). One respondent suggested that this was because there are currently fewer hunters in the forest using shotguns that frighten the elephants away. The presence of elephants nearby, less than 5km from the village (*pers. obs.*) is a source of concern, because of the damage they cause to crops and the danger they pose to people.

As explained below (Section 5.5.3), there are certain animals that some members of the village do not eat. A taboo on eating a particular species does not however prohibit a hunter from killing and selling the animal. Thus it is very possible for a hunter who does not, for example, eat gorilla (*Gorilla gorilla*) to shoot one if he sees one and to sell it to a trader. The trader is able to sell it in Bata because there are people from other regions of Rio Muni who do eat gorilla.

5.5. Rationale for Hunting

5.5.1 Incentives to hunt

When asked why they hunt, the reasons most frequently chosen by the hunters were ‘for food’ and ‘for money’ (Table 5). The data from these hunters shows that on average approximately half of all animals of a particular species that are captured are sold and half are eaten (Figure 8). The animals most likely to be sold are pangolins, ungulates (most commonly duikers) and primates (Figure 8). Birds, carnivores and, most importantly rodents are more likely to be kept and eaten, however these groupings do mask intra-group subtleties. For example 77% of brush-tailed porcupines (*Atherurus africanus*), a species of rodent, are sold (Appendix 7). One important factor that might influence the likelihood of an animal being sold is size, perhaps because very small animals are just not worth selling; there is a modest correlation between average body mass of a species and the proportion of that species sold (Spearman Rank Correlation, $n = 60$, $r_s = 0.50$) (Figure 9). Other factors to consider include sale price (Appendix 6) and personal taste preference.

Table 5. Reasons for hunting, as selected from a list (Hunter Interview, Question 10, Appendix 2) by respondents ($n = 18$, one hunter gave no response, 15 selected more than one reason).

Reason	No. of selections
‘...in order to help my family to eat’	14
‘...because we have no other way of making money’	13
‘...in order to protect my crops’	3
‘...because it is the easiest way of making money’	3
‘...because I like life in the forest’	1

The proportion of the catch that is sold also varies according to the method of hunting used (Figure 10). The difference is statistically significant ($\chi^2 = 25.8$, $df = 12$, $P < 0.05$). The motivation for trapping around the fields is more one of crop protection and captures smaller species that are less commercially valuable (Appendix 6; Appendix 7). The animals ‘collected’ from the forest using means ‘other’ than shotguns or traps also tend to be of less commercial value (Appendix 6; Appendix 7) and are thus more likely to be eaten by the hunter and/or his family rather than sold (Figure 10).

A distinction between commercial hunters and subsistence hunting is difficult to make because the majority of hunters, hunt for food and for money (Figure 11). From a sample of 17 hunters, only two hunters hunt purely for subsistence and only one hunter sells all his catch. He is the only hunter in the village who is not a resident. He only hunts with a shotgun, his own, and lives with his brother-in-law in one of the households. He has been hunting in and around Sendje for eight months, having come from Bata and before that Evinayong (to the east) where he was also hunting commercially.

Figure 8. Mean proportion of catch sold by hunters for different groups of prey. Explanation of how the figures are calculated is given in Appendix 7. The figures in the brackets indicate the number of species of each animal.

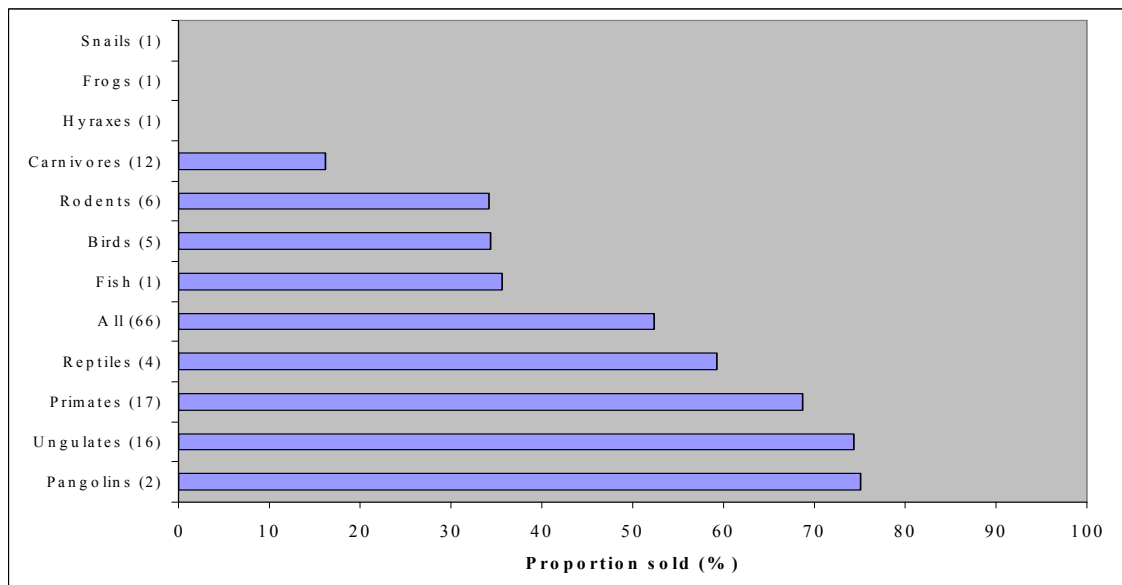


Figure 9. Correlation between body mass and proportion sold of the different prey species (Appendix 7). Values for mean body mass are from Kingdon (2001) and from Fa and Garcia Yuste (2001).

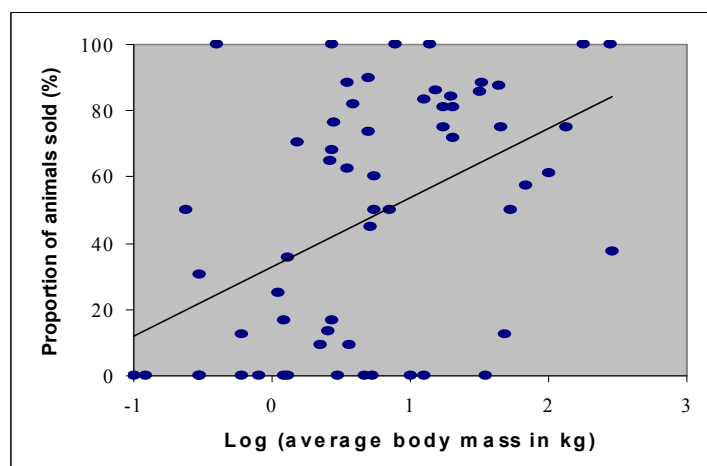


Figure 10. The mean proportion of produce sold by households from the major livelihood activities. Data from all households is combined. The number of households ('n') that carry out the particular activity is indicated.

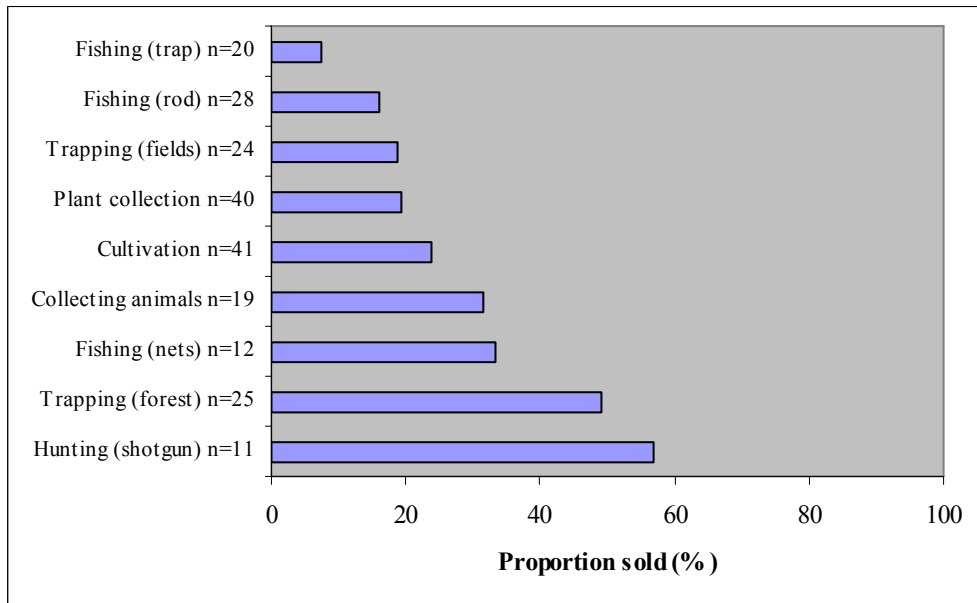
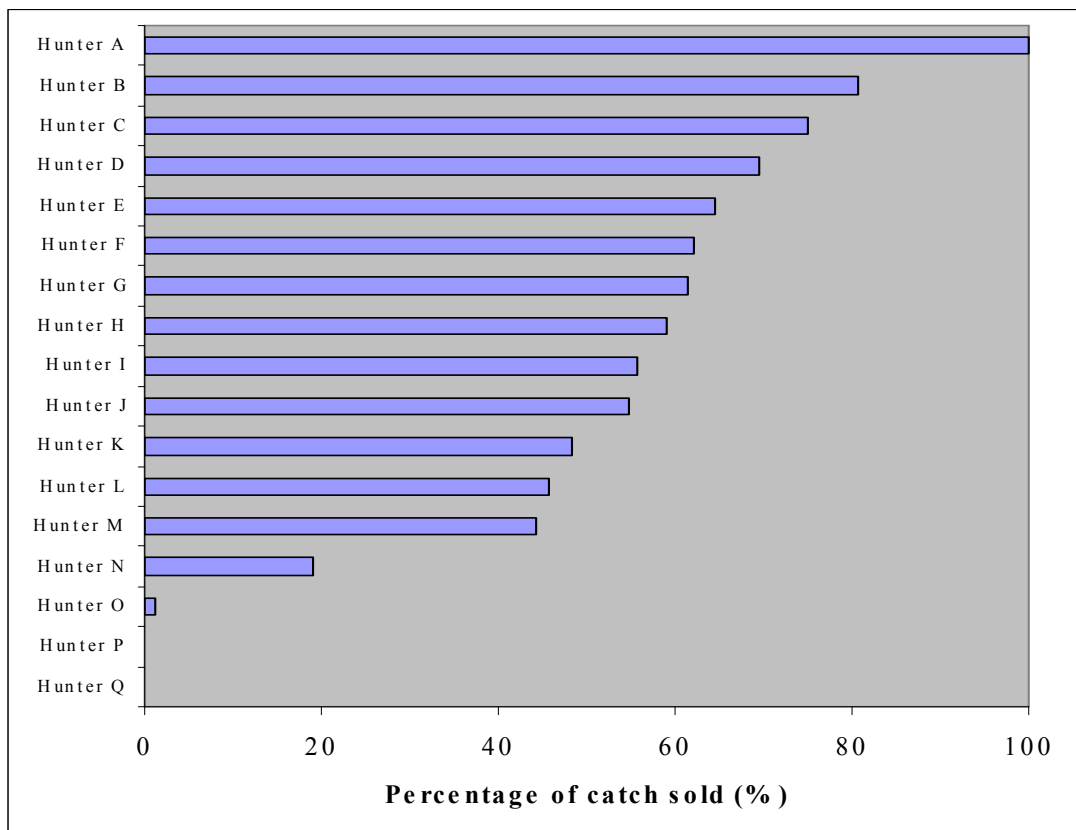


Figure 11. Proportion of catch sold by individual hunters (N = 17). Data for individual prey species has been combined.



5.5.2 Alternative sources of income

Given the reported decline in prey abundance, it is not surprising that all hunters, who offered their opinion, said that they would prefer their sons to find employment rather than hunt. However, as illustrated in Table 5, ‘..because we have no other way of making money’ was chosen as a reason for hunting much more frequently than, ‘..because it is the easiest way of making money’. Furthermore, in almost every household interview the respondent(s) expressed dismay over the dearth of job opportunities. There simply are not many alternative ways of earning money available to the men in the village.

Table 6. Number and percentage of males in the household sample receiving paid work, subdivided by age group and the regularity with which they work.

Age group (years)	Frequency of work				TOTAL	Percentage of age group (%)
	daily	weekly	monthly	rarely		
0-9	0	0	0	0	0	0.0
10-19	1	0	1	0	2	5.9
20-29	3	0	2	2	7	35.0
30-39	2	0	0	0	2	20.0
40-49	2	1	0	0	3	23.1
50-59	2	0	1	1	4	30.8
60-69	0	0	1	0	1	12.5
70-79	1	0	0	0	1	12.5
80-89	0	0	0	0	0	0.0
TOTAL	11	1	5	3	20	16.1

When the logging companies were operating in the area, there were, according to the older respondents, plenty of jobs for the men in the village. The last logging company, however, terminated its operations in the area in 1995. Currently only 26% of the men aged 18 or over are employed, i.e. receive a wage (Table 6). The figure for women is even lower (Figure 3). Just over half of these people are in full-time employment; the rest pick up occasional work. The principal employer is a construction company based in Sendje II. Others work, or have worked very recently as teachers, carpenters, guards,

porters/guides for ECOFAC and one man is a pop-singer! Many of the young men, including the two research assistants employed for this study, had no desire to go hunting but instead were on stand-by for any job opportunities to come their way. In their opinion, securing a job with a company was extremely difficult and required contacts in the company and payment to the person doing the recruiting. It also usually requires a person or family to leave the village and relocate to where a job can be found; typically an urban area. Some respondents disclosed during the household interviews the whereabouts and profession of close relatives who had emigrated from Sendje. Most had gone to Libreville or Bata where they have found jobs as cooks, vendors, taxi-drivers, labourers and teachers.

The entrepreneurial possibilities also appear rather limited, particularly without the capital to set up a business and with few customers in the village able to afford to pay for services or goods. Nevertheless, a few individuals did operate their own enterprises. The majority of these worked as traders, buying manufactured goods from Bata and selling them in the village from a 'bar'. One man, in possession of a chain saw, cuts timber and occasionally sells wooden planks; the major raw material in the construction of a new house. At least two women cooked dough-balls every morning to sell to villagers and passers-by. There is also a family of wood-carvers, who make household utensils for people in the village and carvings to sell in Bata.

The benefit of crops or forest plants as significant sources of income is currently very limited. Whilst 50% of households sell forest plants and 71% sell crops, it is only a minor surplus that is typically sold (19% and 24% respectively for all households combined) (Figure 10). Since all households work their own plot of land, there is a limited market for selling crops to other residents of the village. Therefore, produce must be transported to one of the urban markets. The only plants from the village that serve as cash crops and are sold in bulk (in Bata or Libreville) appear to be citrus fruits: oranges (*Citrus sinensis*), limes (*Citrus aurantifolia*) and pineapples (*Ananas sativus*). People commonly take small quantities of produce with them when making a trip to Bata (for example to buy provisions) to cover the cost of the taxi (\$2.80 round trip).

Fishing is a more widespread activity than hunting, carried out by men, women and children (Figure 3). Nobody bemoaned a lack of fish to catch and observations suggested that is a relatively fruitful activity, even in the wet season when yields are comparatively lower. As with crops though, the potential of fishing as a commercial activity seems limited because residents of the village can catch their own or buy the cheaper frozen fish from Bata or the 'economato' in Sendje II (Figure 10; Appendix 6).

5.5.3 Alternative sources of food

Meat is regarded as an important dietary component beyond it simply tasting nice. The majority of respondents claimed meat has important health benefits. It is good for the 'blood', makes you strong and provides lots of vitamins (Figure 12). Some plant foods were thought to confer these same benefits as meat and therefore serve as substitutes when meat is not available (Figure 13). The most important was a group of spinach-like leafy vegetables called 'verduras' (*Amaranthus spp*); regarded as better substitutes for meat than fish. This may be due in part to the emphasis on the vitamin component of meat as being so important rather than protein - a word that was mentioned only once in the household interviews (unless 'strength' is synonymous with 'protein') (Figure 12). No distinction was made between the benefits of different kinds of meats; that for example eating bushmeat makes a person stronger than eating chicken. This area of questioning was not pressed too far, to avoid excessive focus on bushmeat and so as not to lead the respondent into making false claims for certain meats.

Other plant foods, such as peanuts (*Arachis hypogaea*) and 'chocolate' (*Irvingia gabonensis*) were desirable ingredients for sauces to accompany meat and fish. These complementary foods appeared to be used with all kinds of fish, bushmeat and domestic meat and thus their availability did not appear to influence the choice of meat or fish that was eaten.

Figure 12. The importance of eating meat as stated by respondents (n = 41) to the household interviews. In some interviews more than one response was given.

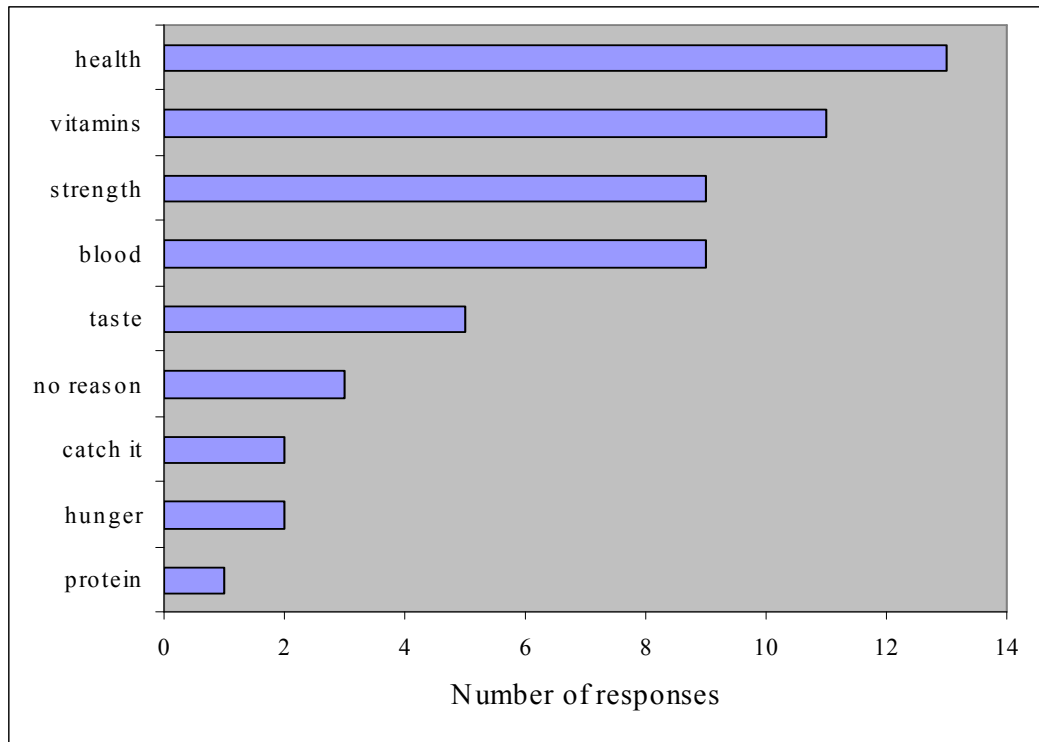
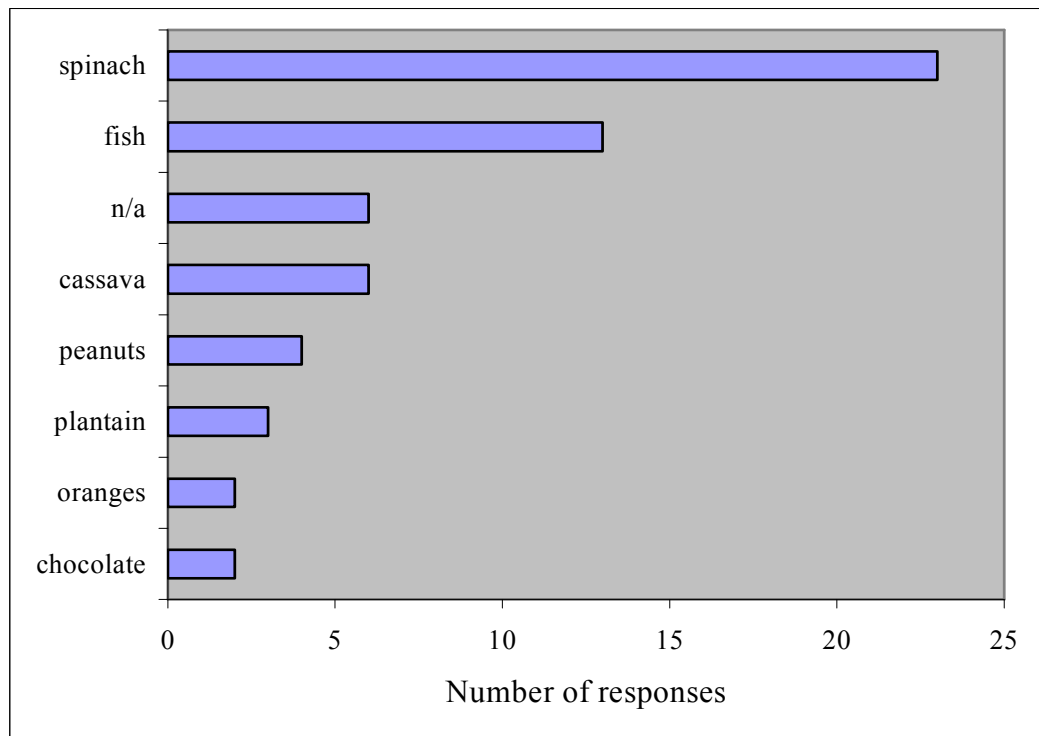


Figure 13. Meat-substitutes as stated by respondents (n = 41) to the household interviews. In some interviews more than one response was given.



Of the ‘meats’ (hereafter to include bushmeat, domestic meat and fish), fish was most commonly eaten (Figure 14; Appendix 9). The difference between the frequencies of consumption of the different meats was statistically very highly significant ($\chi^2 = 288.2$, $df = 8$, $P < 0.001$). Excluding fish, the difference between the pattern of consumption of bushmeat and domestic meat is statistically very highly significant also ($\chi^2 = 28.7$, $df = 4$, $P < 0.001$) but not if the ‘never’ category (Appendix 9) is removed ($\chi^2 = 2.68$, $df = 3$, $P = 0.44$, NS). This is because there is a much higher proportion of bushmeat species or groups that few households ever eat (Figure 14). There are certain species that are captured (Appendix 7) but are never eaten (Appendix 9) that were alluded to in the household interviews as being taboo foods (Table 7). The basis for the taboo was not clear in most cases. All households belonging to one of the tribes (Yebeccoan, $n = 4$) claimed a tribal foundation to their taboos but they were not consistent in the foods that they mentioned. Otherwise an assortment of rather vague reasons were given that were stated as being unrelated to tribe including, ‘..we don’t like to eat them’ (13 responses), ‘..it is bad luck’ (two responses), ‘..our ancestors never ate them’ (six responses) and mysteriously ‘..because I was a boxer in my youth’! The impression given was that as children they had been brought up not to eat certain animals and that this was a practice they had continued to observe in their adult life. In addition, although not strictly taboos, there were certain bushmeats, all small animals, that only children usually eat including frogs, squirrels and small birds.

Figure 14. The frequency with which bushmeat, fish and domestic meat is eaten by households based on the combined data (Appendix 9) for all the different types of food in each category (Question ‘m’, Household Interview, Appendix 1).

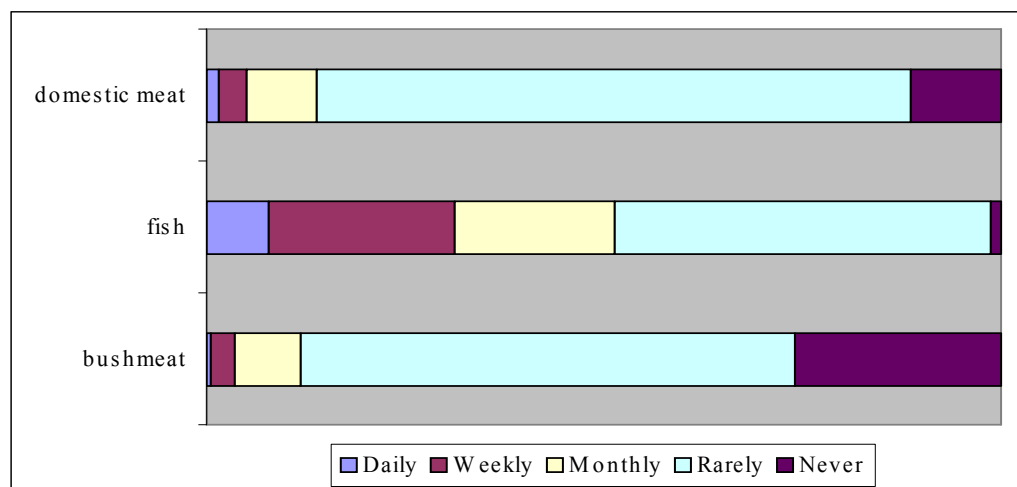


Table 7. Taboo foods as stated by respondents in the household interviews in ascending order of prevalence. The food may be taboo for the entire household, or just for a subsection of the household (men/women/children).

Bushmeat	Number of households stating that the food is taboo for:			
	Men	Women	Children	All
Gorilla (<i>Gorilla gorilla</i>)		3	2	15
Chimpanzee (<i>Pan troglodytes</i>)		3	2	9
Snakes	1	3	1	9
Monitor lizard (<i>Varanus niloticus</i>)		3	1	3
Genet / linsang		6	1	
Tree hyrax (<i>Dendrohyrax dorsalis</i>)		2		4
Tortoise (<i>Kynixis erosa</i>)		5		1
Mongoose		5	1	
Wild cat			1	1
Swamp otter (<i>Aonyx congica</i>)				1
Yellow-backed duiker (<i>Cephalophus silvicultor</i>)				1
Elephant (<i>Loxodonta africana</i>)				1
Palm civet (<i>Nandinia binotata</i>)		1		

The existence of taboos is reflected in the taste preference data, where a much higher number of bushmeat foods were ‘detested’ compared to fish or domestic meats (Figure 15). This fact contributes to there being a very highly statistically significant difference between the taste preference for the different meats ($\chi^2 = 123.9$, $df = 8$, $P < 0.001$). When the ‘detested’ category is removed from the calculation, the difference is reduced (but still very highly significant: $\chi^2 = 32.7$, $df = 6$, $P < 0.001$), and bushmeat as a food group is rated mostly highly according to taste, as opposed to fish (Appendix 9). Furthermore, there is limited evidence that taste-preference might be an important determinant of food consumption patterns. Transformation of the results into scores that can then be ranked makes it possible to establish the strength of correlation between these variables (Appendix 9). This analysis reveals a modest correlation between taste-preference and how frequently the different foods are eaten (Spearman Rank Correlation, $n = 37$, $r_s = 0.45$) (Figure 16).

There is a very highly statistically significant difference in the perceived price of the different meat groups ($\chi^2 = 88.6$, $df = 8$, $P < 0.001$). Fish is perceived as being cheapest and domestic meat is perceived as being more expensive than bushmeat ($\chi^2 = 39.3$, $df = 4$, $P < 0.001$) (Figure 17). The perceived price of the foods however, was not correlated with how often they were eaten (Spearman Rank Correlation, $n = 37$, $r_s = -0.017$) (Figure

18). This is largely due to the small variation in price perception, with the majority of foods (64%) being regarded as 'very expensive'. Indeed some respondents were reluctant to make any distinction at all claiming that all were very expensive and unaffordable.

Figure 15. The stated preferences for bushmeat, fish and domestic meat by households based on the combined data (Appendix 9) for all the different types of food in each category (Question 'p', Household Interview, Appendix 1).

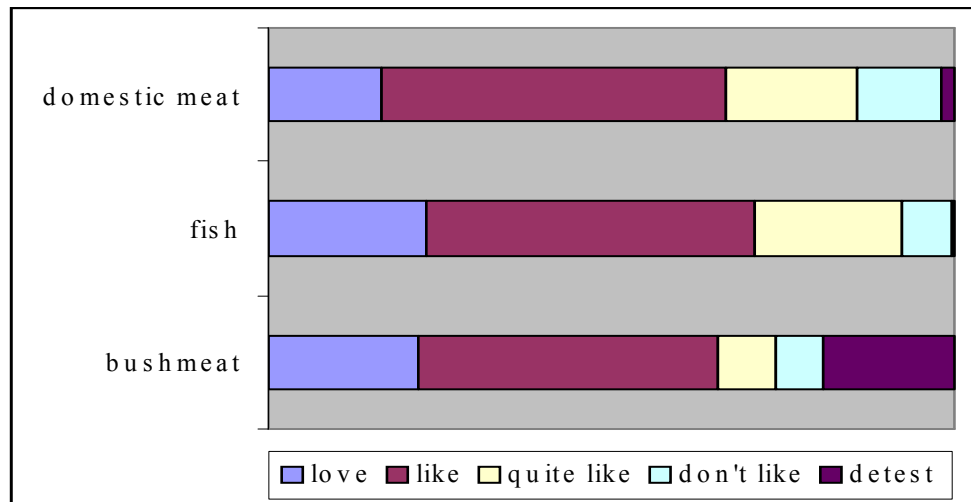


Figure 16. Correlation between taste preference and frequency of consumption for all types of animal protein. The list of foods and calculation of scores is given in Appendix 9.

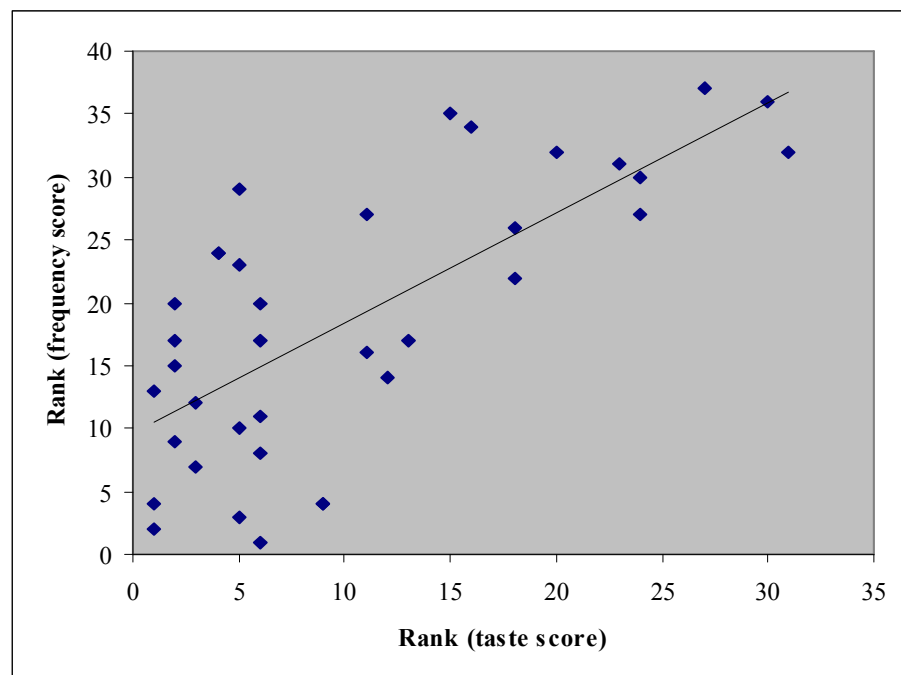


Figure 17. The perceptions of the relative price of bushmeat, fish and domestic meat by households based on the combined data (Appendix 9) for all the different types of food in each category (Question ‘o’, Household Interview, Appendix 1).

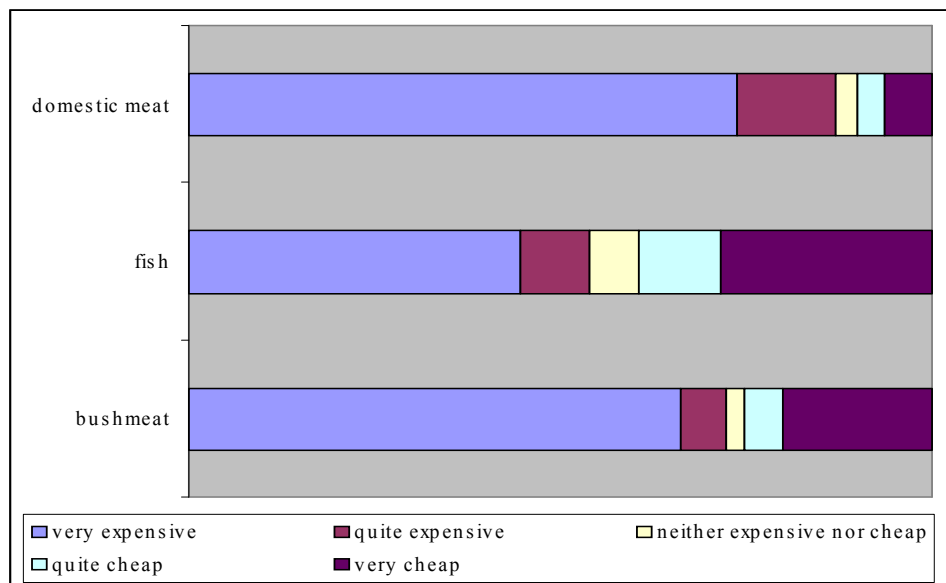
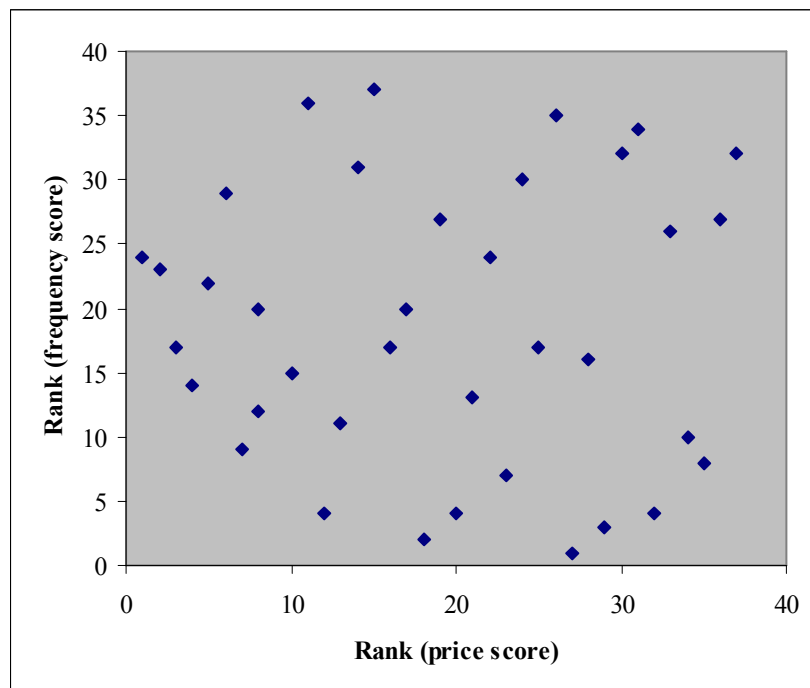


Figure 18. Correlation between price perception and frequency of consumption for all types of animal protein. The list of foods and calculation of scores is given in Appendix 9.



A major variable not considered here is the availability of different foods. This is a particularly important with regards to bushmeat, where the frequency of capture is likely to influence consumption patterns. Elephants, for example, are rarely captured and rarely eaten despite the meat being moderately priced and regarded as tasty (Appendix 9). This is likely to be less significant for domestic meat that can be obtained all year round and for fish, although fishing is, to an extent, a seasonal activity being carried out more in the dry season when water levels are low and children are on holiday.

6. DISCUSSION

The discussion draws together the key results of the study and examines the implications for the management of the wildlife resource. The practicalities and impacts of different interventions are assessed and a management strategy is proposed.

6.1 Key Findings and the Implications for Management

6.1.1 Hunting

Bushmeat extraction is unsustainable. A previous study into the extent and impact of the activities of hunters operating from Sendje recorded a decline in wildlife populations in the hunter catchment based on diminishing returns from hunting between January 1998 and April 1999 (Fa and Garcia Yuste 2001). By comparing the extraction rates with estimated production, the researchers concluded that a number of species were being hunted unsustainably in and around a number of the camps used by the hunters (Appendix 5). The suggestion that the wildlife resource is being overexploited in the area is supported by anecdotal evidence from this study. The perception of both hunters and traders is that prey is increasingly scarce and the level of off-take is in decline. The reported recent departure of itinerant hunters from the village, possibly in response to a lack of prey, could prompt a recovery in prey abundance, however hunting pressure from local hunters remains high. Indeed, 49 hunters were recorded in this study compared to 42 in the earlier study (Fa and Garcia Yuste 2001). A case could therefore be made for reducing hunting pressure on the grounds that current levels of hunting are unsustainable. Such a phenomenon would not be unexpected given the growing body of evidence of a trend towards over-exploitation of wildlife, both countrywide (Fa *et al* 1995; Fa *et al* 2000) and across the region (e.g. Wilkie and Carpenter 1999; Fa *et al* 2002a). Furthermore, Equatorial Guinea is experiencing rapid human population growth, urbanization and developments in its transport infrastructure (World Bank 2002) – all factors increasing the pressure on the wildlife resource (Bowen-Jones and Pendry 1999). The fact that the hunters recognize the decline and its probable causes, suggests that they might be receptive to any proposal to improve the sustainability of

supply. The evidence from elsewhere, however, suggests that for rural people in situations akin to those found in Sendje, a strategy of economic diversification is favoured over sustainable resource management (Noss 1997).

Hunting is a major livelihood activity. Hunting is an activity carried out almost exclusively by men. There is at least one hunter in over 80% of households and over 60% of men of all age groups (aged 20+) currently hunt to some degree and most have hunted (periodically at least) from a young age. For a third of hunters, hunting is a daily activity with little seasonal variation. Therefore any measure that targets hunting will directly affect a significant proportion of men and indirectly affect the majority of households in the village. There was no evidence however that hunting is a cherished or high-status activity (Meñana Nsang 1998). To the contrary, it was regarded as a dangerous, arduous, and unfruitful activity undertaken out of necessity and thus was not an activity that the hunters recommended for their sons. This suggests that the opportunity costs of hunting, currently very low, would not have to be raised considerably for hunters to switch to an alternative profession (Milner-Gulland 2001).

A diversity of hunting methods is employed. The two main methods of hunting are shooting and trapping. Two-thirds of hunters just trap, nearly a third use both methods and only two hunters just use shotguns. Almost all of the traps used by hunters in Sendje are types of cable snare. These are regarded as a highly inefficient and destructive means of capturing animals. A study by Noss (1998) in the Central African Republic concluded that snares were nonselective and wasteful since over a quarter of animals caught in snares were taken by scavengers or decomposed and two out of every five animals caught in the snares escape with injury. It is perhaps not surprising then that cable snares are outlawed in most central and west African countries however this is not the case in Equatorial Guinea (Fa and Garcia Yuste 2001).

Trapping is the most popular means of hunting because the opportunity costs of time are low and trapping is a relatively inexpensive means of hunting compared to hunting with shotguns (Noss 1998). Thus the barriers to participation in this activity are low. In contrast, hunting with shotguns incurs much higher capital and operating costs. In addition, a licence from the district authorities and permission from the Village

President are requirements for using a shotgun in the area. Thus, despite shotgun-hunting yielding higher returns per unit effort, the scarcity of shotguns compounded by high costs appears to be limiting current shotgun use.

Recognizing the distinctions between the two methods is important in the context of management. It would be relatively easy to curtail shotgun hunting by banning firearms as was the case prior to the change of government in 1989 (Fa *et al* 2000). Permits could be withdrawn and even a system of compensation might be offered for confiscated guns. A tax or ban on cartridges might be equally effective rendering shotgun hunting prohibitively expensive. Even if shotgun hunting was completely outlawed, the likely response would be for the level of trapping to increase. The only major beneficiaries are those animals, mostly primates that are currently targeted by shooting (Noss 1998; Fa and Garcia Yuste 2001). Overall hunting pressure would be more dramatically curbed if trapping was banned. The majority of hunters in the village who presently only use traps would be prevented from hunting and they are unlikely to be able to switch to shotgun hunting given the scarcity of shotguns and high costs involved. Not only would the livelihoods of these hunters be severely affected, agriculture is likely to suffer. Over half of all hunters trap in their fields, which serves to protect crops as well as being a source of bushmeat. Of course these impacts would only result if a ban on snares could be successfully implemented. In those countries such as the Central African Republic where the use of snares is banned, the practice continues largely unchecked (Noss 1998). It is simply not feasible to enforce and would antagonize the villagers (Fa and Garcia Yuste 2001).

There is a well-established infrastructure supporting hunting activities. Old logging roads facilitate access to the forest from the village. Within the forest a network of well-trodden paths connect together old abandoned settlements many of which are inside Monte Alèn National Park, that now serve as hunting camps. There are therefore well-defined targets for concentrating enforcement effort. Paths can be patrolled, hunting camps destroyed and traps disabled (Noss 1998). At present the park boundary, a relatively large river, has no influence on where hunting takes beyond acting as a natural barrier to access during periods of heavy rain when, according to the hunters, it

is impassable (the old logging bridge has collapsed). This has been reported elsewhere on the boundaries of the park (Cayuela Serrano 1998; Meñana Nsang 1998).

Hunting is an important source of income. Almost all hunters sell a proportion of their catch, either to residents of the village or to a trader, whose regular visits from Bata ensure that there is always a customer for the hunters to sell to. Only two hunters hunt purely for subsistence and one hunter, an immigrant to the village, sells all of the animals he captures. The proportion of animals sold depends on the species captured, which in turn depends on the method of hunting used and the hunting location. Duikers, monkeys and pangolins are typically sold, whilst other, generally smaller species, such as prosimians, reptiles and rodents are eaten by the hunter and his family. On average, half of the carcasses of a particular species are sold.

It was not possible, due to the brevity of this study to quantify how much money is typically earned from hunting. However, the significance of the hunting-derived income can be evaluated in the context of the alternative sources of income available to the men in the village. Typically for the area, employment opportunities in the village are limited and short-term (Meñana Nsang 1998). Presently, just 26% of men over the age of 18 are employed and only half of these jobs are full-time. It is not unusual for people to emigrate from the village to an urban area in search of work. The potential for new private enterprises is constrained by a lack of local demand, a lack of capital to invest and high transport costs. Whilst there was once a thriving coffee and cacao industry in the area (and the country as a whole) there is currently no organization or support for the development of markets for fish, agricultural produce or livestock (Mba Mba 1998). Thus, in a situation where jobs are rare and ephemeral and other opportunities for making money limited, hunting provides a degree of livelihood security (Bennett 2002). A cash economy prevails in Sendje and money is needed to meet even the most basic subsistence needs. Compounding the problem is the rapid growth in the economy and the associated rising costs of goods (EIA 2002). The implications are that any intervention restricting hunting will have immediate adverse repercussions for the hunters and their families. Ultimately though, if hunting continues unabated at unsustainable levels the same consequences will result. Therefore, any intervention must simultaneously address the employment and income needs of the villagers and to

be acceptable to the hunters, any alternative enterprises must be at least as profitable as hunting (Milner-Gulland 2001).

6.1.2 Trading

The commodity chain is well-established and simple. There is one principal trader who purchases bushmeat from the hunters three times a week. She takes this bushmeat back to Bata in a bush-taxi along the only road that connects Sendje with Bata. In Bata the meat is sold to women who run stalls selling bushmeat in the central market. The trader-link in the supply chain therefore presents an easy target for measures designed to curb the commercial trade in bushmeat from the hunter to the urban consumer (Wilkie and Carpenter 1999).

The profit margins of trading in bushmeat are slim. Since Bata is only 42 km from Sendje, and there is regular traffic passing through the village, a trader cannot offer significantly lower prices to the hunters for bushmeat than is charged in Bata itself, otherwise the hunters would sell directly to customers by the roadside or in Bata. Similarly, highly inflated prices cannot be charged for bushmeat sold to the market vendors in Bata since there are other sources available to the vendors from other parts of the country (Fa *et al* 1995). In addition to the purchase price of the animals or carcasses, a trader must pay for transport and bribes with the larger and/or protected species commanding higher charges. All of these factors compounded by the reported decline in supply of bushmeat result in relatively slim profit margins for traders. Therefore any intervention that increases costs still higher could render the trade unprofitable unless of course the costs are passed on to the urban consumer or hunter. Wilkie and Carpenter (1999) envisage a scenario whereby rising prices in the urban markets drive down demand resulting ultimately in hunters being paid less for their goods. Consequently the commercial potential of hunting diminishes. There already exists a point of control where this type of intervention could be implemented. Currently all vehicles are stopped at a police checkpoint along the main road where the traders are forced to pay bribes. Potentially forest guards could be stationed here and authorized to confiscate bushmeat and charge fines or better still to levy a tax on any bushmeat cargo (Bowen-Jones and

Pendry 1999). The system could be fine-tuned to tax only protected species such as great apes (Wilkie and Carpenter 1999) and the money raised could be used for community development (Bowen-Jones and Pendry 1999). Whilst straightforward in principle, the proposed system is open to abuse and corruption. All it may do is to encourage officials to charge even higher bribes or to confiscate bushmeat that is then resold (Wilkie and Carpenter 1999).

6.1.3 Consumption of bushmeat

Taboos are common. Traditional taboos prohibiting people from eating certain foods are widely held and adhered to. Which animals are taboo to eat varies according to sex, age and household, with little consistency; only the two species of great ape and snakes were commonly taboo. It was not possible to assess whether the situation found in Sendje represents a relaxation of traditional taboos as has been reported in other studies in the region (Infield 1988 cited in Bowen-Jones 1998; Meñana Nsang 1998). It has been suggested that reinforcing these taboos might work as a strategy towards reducing exploitation of wild animals, perhaps as part of a wider education programme (Bowen-Jones and Pendry 1999). However this is likely to be ineffectual for a number of reasons. Firstly the taboos are somewhat individualistic, secondly a taboo does not preclude the capture and sale of the animal concerned and lastly (and fundamentally) society has become far removed from that in which traditional social controls were developed and could be applied (Rose 2001).

Bushmeat presents a minor food security issue. Hunting for bushmeat provides an important source of animal protein. All hunters, bar one, retain a proportion of the bushmeat for the cooking pot. All households consume bushmeat and purchase bushmeat, particularly those species that are rarely captured. Meat is widely regarded as an important component of the diet; needs which can be met not just from bushmeat but from domestic meats, fish and certain plant foods. Of the three sources of animal protein available, fish is most commonly eaten, it is perceived as being the cheapest and the tastiest, although bushmeat tops the taste preference list if taboo species are discounted. What factor best determines consumption patterns of these foods could not be resolved.

There was no evidence that price perception had any discernible effect, perhaps because most meats and fish are regarded as equally expensive. Taste preference was more strongly correlated with the consumption frequency. Although the methodology and analysis is different, this trend mirrors to some extent findings from Bioko Island (Fa *et al* 2002b). In this study, availability was the most significant determinant of consumption followed by taste and then price. The list of foods given to respondents in the household interviews represents what is available to consumers in Sendje; that can be captured, reared or bought. However, the supply of fish can be seasonal and certain bushmeat species are rarely caught so availability might be an important determinant.

The results show that people in Sendje are not entirely dependent on bushmeat as a source of protein and although this was not clearly shown, demand for bushmeat is likely to be elastic (Milner-Gulland 2001). This is of crucial importance because interventions that curb or curtail hunting can bring about serious food security problems for local people (Bennett 2002). In Sendje, fish and domestic meats are widely available as substitutes. The evidence suggests that people could switch over entirely to these sources of animal protein since bushmeat is not significantly cheaper, preferred or more available (Wilkie and Carpenter 1999). Fish currently offers the best alternative, both imported and locally caught, however fish stocks just like bushmeat can be overexploited (Chin 2001 in Bennett 2002). At present the potential of domestic meat as a substitute appears under-developed. Whilst most families possess some livestock, numbers are too few and animals too valuable to obtain a regular supply of meat from this source. Domestic meat can be bought from the economato in Sendje II but this is also expensive. Increasing the levels of livestock husbandry offers a possible solution but clearly if this was straightforward it would already be more highly developed. Barriers to expanding the role of livestock include capital costs of the initial stock, training and fencing plus operating costs of supervision and veterinary care (Newing 2001; Bowen-Jones *et al* 2002). Fundamentally, addressing the issue of providing substitutes for bushmeat does not necessarily tackle the role that hunting plays in providing an income for the hunters and their families. Providing cheap alternatives to bushmeat may simply result in hunters becoming more commercialized selling a greater proportion of their catch to traders and spending the money on the cheaper substitutes available.

6.1.4 Community structure

Sendje is currently a cohesive, stable community. Ethnic diversity is low, the majority of households have lived in Sendje for over 30 years and blood ties between households are close. There is also a long-established hierarchy of Village President, Vice-President and tribal chiefs (Mba Mba 1998). Regular village meetings give the community the opportunity to air its views, which are represented at the district-level by the village chiefs. Thus a structure is in place within the community to facilitate the successful implementation of community-wide measures (Noss 1997). Historically, however, major changes to the population and socioeconomic situation in the village have been wrought by the arrival of logging companies to the area and to a lesser extent of itinerant commercial hunters (Auzel and Hardin 2001). There is also a regular emigration of villagers to urban centres in search of work, a phenomenon that is likely to increase in light of the recent expansion of the activities of oil companies on the mainland, particularly in Bata (EIA 2002). Any management strategy must be robust in the wake of such changes (Milner-Gulland 2001).

Control is exerted over activities undertaken within the jurisdiction of the village.

Permission from the Village President must be sought to clear land, build a house, settle in the village or use a shotgun in the village. This may simply be a formality however the existence of this point of control does increase the likelihood of successful implementation of measures if support of the Village President is secured. Caution must be exercised however in endowing those in a senior position with too much influence that may result in abuse and alienation of the rest of the community (Gibson and Marks 1995).

6.2 Management Strategy

The preceding appraisal of different management interventions is necessarily based on imperfect data. To understand the situation fully, requires data collected over time on a whole host of biological, social and economic parameters not touched on in this study (Millner-Gulland and Mace 1998). Nevertheless I believe that sufficient data has been gathered in this study to inform a decision-making process as to the most appropriate

management strategy for the mitigation of hunting in the area. Moreover, the level of uncertainty inherent in certain types of data, given the methods employed, is so great as to question the usefulness of such data (e.g. prey population censuses, Newing 2001). There is therefore a strong argument for diverting limited resources and attention away from repeated data collection to the more pressing problem of mitigation using what data there is available (Wilkie and Carpenter 1999).

Mitigation is a pertinent line of investigation to pursue since developments are already afoot to address the problem of bushmeat extraction in Monte Alèn National Park, with particular emphasis on Sendje. As previously mentioned, ECOFAC has recently established a camp for park guards on the park boundary (Appendix 5) and at least one arrest of a hunter operating in the park has been made. Such arrests have legal backing in the form of 'Law No. 8 / 1998 regarding Wildlife, Hunting and Protected Areas' that prohibits hunting in protected areas and recommends a minimum fine of 10,000 CFA francs (\$14.00) for any infraction (WCMC 2002). I recommend that protection of the park from hunting be stepped up. This can be achieved relatively efficiently given that the western boundary of the park is delineated by a large river (Appendix 5), clearly establishing for hunters and guards alike where hunting can and cannot take place. Also, enforcement efforts can be concentrated along well-established routes of access into the forest and around hunting camps. These camps could be destroyed and traps disabled thereby dismantling the infrastructure on which the hunters depend (Meñana Nsang 1998; Noss 1998). In this way, the national park would be a properly protected core area serving as a 'source' of prey for hunters to exploit in the 'sink' area between the park boundary and the village (Bowen-Jones and Pendry 1999). Currently, the size of the core area is being increasingly eroded as hunters venture further into the park to find prey. This also results in traps being attended less regularly, increasing the level of wastage through animals being lost to scavengers and the decomposition of carcasses (Newing 2001). The impact of the measure on hunting should be minimal since it is only some trappers who currently enter the park. Also, if the theory of source-sink dynamics works in practice the buffer zone outside the park will be continually replenished with prey. If it does then hunters can maintain off-take at a lower hunting effort since there would be no further need for protracted hunting trips. Such a measure

is also attractive since it requires no new legislation and hunting to protect crops would not be affected.

Excessive restriction of subsistence hunting is both unfeasible to enforce and ethically questionable (Wilkie and Carpenter 1999). In contrast the hunting and selling of bushmeat that is exported from the village should be controlled by the levy of fines or taxes on traders inspected at the police checkpoint along the Sendje-Bata road. Once again the legislation already exists to support such a measure if it were restricted to protected species. This is a desirable intervention because cutting off the supply to the urban market reduces the effective size of the population exploiting the resource. If this measure was widely applied then prices in the urban markets are likely to increase and demand will fall if the demand for bushmeat is elastic (Wilkie and Carpenter 1999). There are problems with the implementation of such a measure, not least the issue of how to tackle the system of bribes that already exists and might continue, thus circumventing any taxation measure (Milner-Gulland 2001). The tax collectors would have to be well paid and closely monitored (Wilkie and Carpenter 1999). The major problem is how to offset the loss of revenue to hunters in the village that this intervention would bring about. Some meat is sold to people in the village but without the existence of traders, hunter-income would fall.

There is a possibility in the near future (Michael Allen *pers. comm.*) that an education programme will be started up for communities located on the boundaries of the park. It is clear that the location and purpose of the national park has not been communicated properly and the issue of protected species plus any proposed measures such as a clamp-down of hunting within the park need to be discussed with the communities prior to implementation, otherwise they are unlikely to be effective (Wilkie and Carpenter 1999). The organization of the community lends itself to successful introduction of an education programme; via the school, the village hierarchy, village meetings and district meetings. In light of the recognition amongst hunters that prey are in decline, the audience is likely to be more receptive to any proposals that aim to secure a sustainable source of bushmeat. However, given the 'boom and bust' economic strategy inherent in the region and the consequent lack of a conservation ethic, the support for sustainable exploitation will be weak unless short-term benefits are realized (Noss 1997). None of

the hunters wanted their sons to hunt and thus may be less interested in conserving bushmeat species than education or employment opportunities (Infield 1998 in Noss 1997).

An education programme could lay the foundations for a more comprehensive integrated conservation and development project (ICDP) (Noss 1997). The main priority of such a project must be to improve the economic situation of the community development, particularly for those who currently hunt. At present, hunting is one of the few sources of income available to the men in the village, the majority of whom are unemployed and both of the measures outlined above are likely to result in a reduction in incomes for hunters, in the short-term at least. Substitute sources of income must be found that are mutually incompatible with hunting, resilient to changes in circumstances, more profitable than hunting and that benefit individual hunters directly (Milner-Gulland 2001). Projects to develop the commercial potential of livestock rearing and agriculture have the added benefit of increasing the supply of bushmeat substitutes. Pigs, for example, are highly productive (Feer 1993 in Wilkie and Carpenter 1999), are commonly reared in other parts of the country (*pers. obs.*) and there is, at present, little recycling of domestic waste that could be used as feed (Bowen-Jones *et al* 2002). Assistance would be needed though to provide the capital to buy the initial stock, to provide training in animal husbandry, veterinary support and to pay for fencing (Newing 2001). Costs however, are likely to remain high and imported meat may continue to be a cheaper alternative (Bowen-Jones *et al* 2002). Also, cooperatives could be set up to market agricultural produce (Meñana Nsang 1998) to help re-develop agriculture as a commercial activity (Mba Mba 1998). Another approach taken by ECOFAC with villages elsewhere on the park boundary is to establish 'economatos' in the village, providing basic goods at cost thereby reducing the income needs of households and providing cheaper alternatives to bushmeat (Garcia Yuste 1995). However, to establish an economato in Sendje is likely to cause conflict with bar owners and will have no effect on the commercial incentive to hunt.

As has been found elsewhere, more than anything, the men want jobs; formal employment just as many have had, periodically, with a logging company or a construction company (Noss 1997). Addressing this need through an ICDP is clearly

very difficult. Ecotourism in the region could generate employment opportunities and create a self-interest in conservation of the forest ecosystem (Heymans 1994; Garcia Yuste 1995). It is likely though that any ecotourism development or sport-hunting venture would be based at ECOFAC headquarters at Monte Alèn where the infrastructure and organisation already exists to receive guests. Nevertheless, Sendje does have attractions in the form of high primate diversity (Garcia Yuste 1995), forest elephants, dramatic river rapids and now an ECOFAC camp not far from the village. Given the hassles personally experienced working in the country, developing ecotourism is likely to require strong government support to allow tourists to travel unhindered in the country.

What is clear is that no single solution will mitigate bushmeat extraction in the area satisfactorily. If command-and-control measures are to be implemented to prevent hunting from occurring inside the park and to stop the commercial trade in bushmeat then compensatory measures must be developed alongside that confer short term as well long term benefits to the community (Noss 1997). At the risk of making the residents of Sendje guinea pigs for madcap conservation schemes, I feel that without trying out different initiatives, progress on learning how best to tackle the bushmeat problem will stall. With education, careful monitoring and a more adaptive approach to management the answers may become clearer (Shea, K. 1998).

7. SUMMARY AND CONCLUSIONS

This project has examined the role hunting plays in a rural community in Equatorial Guinea. By living in the community, being able to observe daily activities and talk to local people, backed up by more rigorous data collection from interviews, has made it possible to appreciate the level of dependence on bushmeat for food and for income. Given the time constraints, the difficulties of carrying out research in the country and a degree of sensitivity over the issue concerned, the data is necessarily incomplete, superficial, biased, unverified and anecdotal! Ideally more of the data would have been collected by direct observation, for example of hunting off-take, prices, hunter behaviour and food consumption over a considerable period of time. To do this would have required an army of assistants to collect data, the reliability of which might be equally questionable. One major limitation is the lack of convincing evidence that hunting in the area around Sendje is unsustainable; an assumption that underpins the thrust of the research. Without this it is difficult to justify any management intervention. Nevertheless, hunting does occur inside Monte Alèn National Park, and it is this that is generating immediate interest in intervention measures.

In spite of these deficiencies which are to an extent inherent in this type of study, I believe the findings do ultimately reflect the current situation in Sendje and offer some general insight into the complexity of a problem that has, to date, proved intractable to resolve across the region. Most importantly I hope that the conclusions of the study help to inform any decisions that are to be made over the management of bushmeat hunting in Sendje and other settlements on the fringes of the national park. The recommendations are as follows:

- To open channels of communication with the residents of the village to provide the information that is currently lacking regarding the designation of the Monte Mitra extension to Monte Alèn National Park and its implications and to discuss any future developments.

- To enforce the prohibition of all types of hunting within Monte Alèn National Park by the residents of Sendje through regular patrols of the access routes and camps used by hunters.
- To permit the continuation of hunting outside the national park but constrain its purpose to one of domestic supply only by fining or taxing traders caught transporting bushmeat, in particular, protected species.
- To introduce education programmes that foster an understanding of conservation, sustainability and pride in the natural resources of the area.
- To provide the resources to develop the commercial potential of agricultural crops, forest plants and livestock-rearing.
- To monitor the impacts of any interventions so as to learn more about the system being managed so that the strategy can evolve.

8. REFERENCE LIST

- Auzel, P. and Hardin, R. (2001). Colonial history, concessionary politics and collaborative management of equatorial African rain forests. In: *Hunting and bushmeat utilisation in the African rainforest: perspectives towards a blueprint for conservation action*, pp 21-38. Eds. M.I. Bakarr, G.A.B.D. Fonseca, R.A. Mittermeier, A.B. Rylands and K.W. Painemilla. Conservation International, Washington D.C.
- Bennett, E.L. and Robinson, J.G. (2000). Hunting for sustainability: The start of a synthesis. In: *Hunting for sustainability in tropical forests*, pp. 499-519. Eds. J.G. Robinson and E.L. Bennett. Columbia University Press, New York.
- Bennett, E.L. (2002). Is there a link between wild meat and food security? *Conservation Biology* **16**, 590-592.
- Bowen-Jones, E. (1998) *A Review of the Commercial Bushmeat Trade with Emphasis on Central/West Africa and the Great Apes*. Ape Alliance, London, UK.
- Bowen-Jones, E. and Pendry, S. (1999). The threat to primates and other mammals from the bushmeat trade in Africa, and how this threat could be diminished. *Oryx*, **33**, 233-246.
- Bowen-Jones, E., Brown, D. and Robinson, E. (2002). Defra report: Assessment of the solution-orientated research needed to promote a more sustainable bushmeat trade in Central and West Africa [Online]. Available from: <http://www.defra.gov.uk/wildlife-countryside/resprog/findings/bushmeat.pdf> [2002, Aug. 20].
- Campion, C. (2002). The booming illegal trade in bushmeat. *Evening Standard*, London, April 12th.
- Cayuela Serrano, N. (1998). *Dinamica de ocupacion y utilizacion del medio en el Parque Nacional de Monte Alèn*. Programa ECOFAC: Guinea Ecuatorial/APFT/AGRECO. Brussels, Belgium.
- Chambers, R. (1994). The origins and practice of participatory rural appraisal. *World Development*, **22**, 953-969.
- CIA (2002). CIA World Factbook: Equatorial Guinea [Online]. Available from: <http://www.cia.gov/cia/publications/factbook/geos/ek.html> [2002, July 10].
- Davies, G. (2002). Bushmeat and international development. *Conservation Biology*, **16**, 587-589.

- ECOFAC (2002). ECOFAC Regional Programme [Online]. Available from: <http://www.ecofac.org/Composantes/GuineeEquatMonteAlen.htm> [2002, July 18].
- EIA (2002). Equatorial Guinea Country Analysis [Online]. Available from: <http://www.eia.doe.gov/cabs/eqguinea2.html> [2002, July 10].
- Fa, J.E., Garcia Yuste, J.E. and Castelo, R. (2000). Bushmeat Markets on Bioko Island as a Measure of Hunting Pressure. *Conservation Biology*, **14**, 1602-1613.
- Fa, J.E. and Garcia Yuste, J.E. (2001). Commercial bushmeat hunting in the Monte Mitra forests, Equatorial Guinea: extent and impact. *Animal Biodiversity and Conservation*, **24**, 31-52.
- Fa, J.E., Peres, C.A. and Meeuwig, J.A. (2002a). Bushmeat exploitation in tropical forests: an intercontinental comparison. *Conservation Biology*, **16**, 232-237.
- Fa, J.E., Juste J., Burn, R.W and Broad, G. (2002b). Bushmeat consumption and preferences of two ethnic groups in Bioko Island, West Africa. *Human Ecology*, **30**, 397-416.
- FAO (2002). Forestry Resources: Equatorial Guinea [Online]. Available from: http://www.fao.org/forestry/fo/country/index.jsp?lang_id=1&geo_id=8 [2002, August 20].
- Garcia Yuste, J.E. (1995). Inventario y censo de las poblaciones de primates del Parque Nacional Monte Alèn. ECOFAC/AGRECO-CTFT, Brussels, Belgium.
- Gibson, C.C. and Marks, S.A. (1995). Transforming rural hunters into conservationists: an assessment of community-based wildlife management programs in Africa. *World Development*, **23**, 941-957.
- Gonzalez-Kirchner, J.P. (1994). *Ecología y Conservación de los Primates de Guinea Ecuatorial*. Monografías de Antropología No. 1, Ceiba Ediciones, Cantabria.
- Heymans, J.C. (1994). *Utilisation rationnelle de la faune sauvage: élevage de petit gibier*. Ministère de l'Agriculture, Pêche et Alimentation: République de Equatorial Guinea/AGRECO-CTFT, Brussels, Belgium.
- Kingdon, J. (2001). *The Kingdon field guide to African mammals*. Academic Press, London.
- Lasso Alcalá, C.A. (1995). *Biodiversidad animal del Parque Nacional de Monte Alèn*. Proyecto ECOFAC: Componente Guinea Ecuatorial/AGRECO-CTFT/Asociación Amigos de Coto Doñana.
- Mba Mba, J.A. (1998). *Estudio antropológico del poblado del Misergue concentrado: Fase I*. Report to Proyecto ECOFAC - Componente Guinea Ecuatorial.

- Meñana Nsang N.M. (1998). *La Caza en la zona de Monte Alèn*. Proyecto ECOFAC: Componente Guinea Ecuatorial.
- Milner-Gulland, E.J. and Mace, R. (1998) *Conservation of biological resources*. Blackwell Science, Oxford.
- Milner-Gulland, E.J. (2001) Assessing sustainability of hunting: insights from bioeconomic modelling. In: *Hunting and bushmeat utilisation in the African rainforest: perspectives towards a blueprint for conservation action*, pp. 113-151. Eds. M.I. Bakarr, G.A.B.D. Fonseca, R.A. Mittermeier, A.B. Rylands and K.W. Painemilla. Conservation International, Washington D.C.
- Newing, H. (2001). Bushmeat hunting and management: implications of duiker ecology and interspecific competition. *Biodiversity and Conservation*, **10**, 99-118.
- Noss, A.J. (1997). Challenges to nature conservation with community development in central African forests. *Oryx*, **31**, 180-188.
- Noss, A.J. (1998). The impacts of cable snare hunting on wildlife populations in the forests of the Central African Republic. *Conservation Biology*, **12**, 390-398.
- Oates, J.F., Abedi-Lartey, M., McGraw, W.S., Struhsaker, T.T. and Whitesides, G.H. (2000) Extinction of a West African red colobus monkey. *Conservation Biology*, **14**, 1526-1532.
- Pretty, J.N., Guijt, I, Scoones, I. and Thompson, J. (1995). *A Trainer's Guide for Participatory Learning and Action*. IIED, London.
- Redford, K.H. (1992). The empty forest. *Bioscience*, **42**, 412-422.
- Robinson, J.G. and Redford, K.H. (1991). Sustainable harvest of neotropical forest animals. In: *Neotropical Wildlife Use and Conservation*, pp 415-429. Eds. J.G. Robinson and K.H. Redford. University of Chicago Press, Chicago.
- Rose, A.L. (2001). Social change and social values in mitigating bushmeat commerce. In: *Hunting and bushmeat utilisation in the African rainforest: perspectives towards a blueprint for conservation action*, pp. 59-73. Eds. M. I. Bakarr, G.A.B.D. Fonseca, R.A. Mittermeier, A.B. Rylands and K.W. Painemilla. Conservation International, Washington D.C.
- Shea, K. (1998). Management of populations in conservation, harvesting and control. *Tree*, **13**, 371-375.
- UNDP (2002). Human Development Indicators 2002 [Online]. Available from: http://hdr.undp.org/reports/global/2002/en/indicator/indicator.cfm?File=cty_f_GNQ.html [2002, Sept. 6].
- U.S. Department of State (2002). Background Note: Equatorial Guinea [Online]. Available from: <http://www.state.gov/r/pa/ei/bgn/7221pf.htm> [2002, July 10].

- WCMC (2002). 1992 Protected Areas of the World: A review of national systems [Online]. Available from: http://www.wcmc.org.uk/cgi-bin/pa_paisquery.p [2002, April 9].
- Wilkie, D.S. and Carpenter, J.F. (1999). Bushmeat hunting in the Congo Basin: an assessment of impacts and options for mitigation. *Biodiversity and Conservation*, **8**, 927-955.
- Wilkie, D.S. and Godoy, R.A. (2001). Income and price elasticities of bushmeat demand in lowland Amerindian societies. *Conservation Biology*, **15**, 761-769.
- World Bank (2002). Equatorial Guinea Data Profile [Online]. Available from: <http://devdata.worldbank.org/external/CPProfile.asp?CCODE=GNQ&PTYPE=CP> [2002, July 10].
- Wright, S.J., Zeballos, H., Dominguez, I., Gallardo, M.M., Moreno, M.C. and Ibáñez, R. (2000) Poachers alter mammal abundance, seed dispersal and seed predation in a Neotropical forest. *Conservation Biology*, **14**, 227-239.

APPENDIX 1

This is an English translation (from Spanish) of the final household interview.
Directions for the interviewer are given in italics.

HOUSEHOLD INTERVIEW

Interviewers:	Date:
Interviewees:	Location:
Household code:	Start time:
Household head:	Finish time:

Household details

- a) How many properties belong to the household?

Living quarters	Kitchens	Bars	Talking houses

- b) How many people currently live in Sendje as members of your household - what are their names, ages and sex?

(Information is inserted into the table below)

- c) What tribe do you belong to?

- d) How many years have you lived in Sendje?

- e) Where did you live before?

- f) Why did you move to Sendje?

Activity	b+g) Household members (names)								h) Seasonal variation	i) % sold
AGE										
SEX										
Fishing (line)										*
Fishing (trap)										*
Fishing (nets)										*
Hunting (shotgun)										*
Trapping (forest)										*
Trapping (plantations)										*
Collecting timber										*
Construction										
Clearing plantations										
Collecting animals										*
Employment										
Carving										*
Selling products										
Crop cultivation										*
Collecting plants (forest)										*
Collecting firewood										*
Preparing food										
School										

Livelihood activities

- g) For each person in the household (*name read out*), what activities do they do and how often do they do them?
- 1) daily (or almost every day)
 - 2) weekly
 - 3) monthly
 - 4) rarely
 - 5) never

(Activities cards are shown to the respondent and the description of the activity written on them is read out in Spanish and Fang. The respondent selects the appropriate cards and sorts them into piles according to how frequently the activity is carried out. Numbers (1, 2, 3, 4, or 5) are inserted into the table above.)

- h) Is the level of activity the same all year round? (*Information is inserted into the table above.*)

- i) What proportion of the products from these activities do you sell?
- 1) all
 - 2) more than half
 - 3) approximately half
 - 4) less than half
 - 5) nothing

(Cards of those activities carried out by one or more members of the household that generate saleable items are selected and placed into the most appropriate pile by the respondent. The results, as numbers are inserted into table.)*

- j) Do you keep any animals? If so, how many?

Chickens	Ducks	Goats	Sheep	Pigs	Dogs	Cats

- k) Are they to eat, sell or for something else?

- l) How many fields/plantations do you have?

Foods

(For the following four questions (m, n, o and p) cards, each with a different food written on them, are read out in turn and handed to the respondent to be placed in the most appropriate pile. The results, as numbers are inserted into the second table below.)

m) How often do you eat each of these foods?

- 1) daily (or almost daily)
- 2) weekly
- 3) monthly
- 4) rarely
- 5) never

n) By what means do you obtain each of these foods that you eat? *(i.e. only those food cards placed in piles 1-4 in question 'm')*

- 1) buy
- 2) exchange / barter
- 3) gift
- 4) rear
- 5) capture

o) How expensive is each of these foods?

- 1) very expensive
- 2) quite expensive
- 3) neither expensive nor cheap
- 4) quite cheap
- 5) very cheap

p) How much do you enjoy eating these foods?

- 1) love
- 2) like
- 3) quite like
- 4) don't like
- 5) detest

q) Are there any types of meat that you are not allowed to eat?

r) Why is it important for you to eat meat?

s) Are there any types of food that you would eat in place of meat that provides you with the same benefit?

t) Does everybody in your family eat the same type and quantity of meat?

Food	m) frequency	n) source	o) price	p) taste
Antelope (small)				
Squirrel				
Wild bird				
Buffalo				
Antelope (large)				
Crab				
Snail				
Goat / sheep				
Pig				
Cow				
Tinned meat				
Chimpanzee				
Crocodile				
Elephant				
Forest cat				
Gorilla				
Bush pig				
Monitor lizard				
Freshwater shrimp				
Cane rat				
Monkey				
Genet / linsang				
Mongoose				
Palm civet				
Pangolin				
Duck				
Fresh fish				
Frozen fish				
Tinned fish				
Dried fish				
Fresh chicken				
Frozen chicken				
Porcupine				
Frog				
Rat				
Snake				
Tortoise				

APPENDIX 2

This is an English translation (from Spanish) of the final hunter interview. Directions for the interviewer are given in italics.

HUNTER INTERVIEW

Interviewers:	Interview code:
Hunter name:	Date:
Hunter age:	Location:
Household head:	Household code:

1. How long have you lived in Sendje?
2. For how many years have you been hunting/trapping?
What did you do before you started hunting/trapping?
3. Looking at these cards which list different livelihood activities, how often do you do each activity? *(Show activities cards to the hunter and ask them to pile sort the cards into categories 1-5 below; insert results into table.)*
 - 1) daily (or almost daily)
 - 2) weekly
 - 3) monthly
 - 4) rarely
 - 5) never

Activity	Frequency
Fishing (line)	
Fishing (trap)	
Fishing (net)	
Hunting (noose/lassoo)	
Hunting (shotgun)	
Trapping (forest)	
Trapping (fields)	
Collecting wild animals	
Collecting wild plants	
Collecting firewood	
Collecting timber	
Construction	

Traditional handicrafts	
Clearing fields	
Crop cultivation	
Preparing food	
Selling products	
Employment	
School	

4. What methods do you use to hunt: gun, bow and arrow, traps, noose/lasso, dogs, spear, machete, nets or any other method?
(*If trapper*) How many traps do you have?

5. How much time do you spend hunting with each method?
Why?
Which method is better?

6. Do you go on specific hunting/trapping trips?
(*If yes*) How often and how long are your hunting trips (e.g. in a typical month/week)?

7. Where do you hunt/trap? (*Show map of area around Sendje and use as focus of discussion.*)

8. Do you hunt/trap during the day or at night or both?
What proportion of each?
Why?

9. Do you normally hunt/trap on your own or with other people?
Why?
(*If with others*) With whom normally?

10. Why do you hunt/trap? (*Ask the hunter to pick out the main reasons for hunting from the different options detailed below, each written on a separate card in Spanish; ask why he chose those reason(s) and which is/are the most important, and record his reactions to each card as it is read out.*)
 'I hunt...
 - a) '...because I am a good hunter and I like it'
 - b) '...because it is a tradition in my family'
 - c) '...because I like life in the forest'
 - d) '...because it is normal work for a man'
 - e) '...in order to protect my crops'
 - f) '...because we prefer bushmeat to domestic meat'
 - g) '...because the women think that I am strong'

- h) ‘...in order to help my family to eat’
- i) ‘...because we have no other way of making money’
- j) ‘...because it is the easiest way of making money’
- k) ‘...for another reason...’ (*Ask hunter to specify what.*)

11. Do you prefer to hunt/trap particular species?
 (If yes) Which one(s)?
 Why?

12. With what frequency do you catch each type of animal? (*Show animal flashcards and ask the hunter to pile sort them into categories 1-3 below. As the cards are shown and Fang names read out for clarification, ask him to specify whether animals are hunted with guns, trapped, or caught by some other method. Put aside the animals in categories 1 and 2 for question 16*)

- 1) a lot
- 2) a little
- 3) never

13. Are there any species that you deliberately do not catch?
 (If yes) Which ones?

Why do you avoid them? (Is it because they are not permitted, you don’t like them, they are not profitable or it is bad luck...?)

14. Do you hunt/trap in order to protect your crops?
 Which species are you trying to control?

15. Are there any particular seasons of the year when you capture more or less animals? Or when you hunt/trap more or less?

When and why? (*Show seasonal calendar with months and ‘invierno’, ‘primavera’, ‘verano’ and ‘otono’ marked on.*)

Is it easier to capture any particular animals in any particular months/seasons?

16. Do you think that there are more, less or the same number of animals in the forest than in the past?

If there has been an increase or decrease, has it been gradual or suddenly gone up/down? If the change was sudden, when was it?

Why do you think the numbers of animals have changed?

17. What proportion of each type of animal do you sell? (*Ask the hunter to pile sort those animals stated as caught in question 12 into the categories 1-5 below.*)

- 1) all
- 2) more than half

- 3) about half
- 4) less than half
- 5) none

18. Who do you sell your animals to?

19. Do you sell more fresh or smoked meat?
Why?

20. (*If hunter*) Do you own your own gun?
(*If not*) Do you borrow or hire it?
From whom?
Do you use it exclusively?
(*If hired*) How much do you pay to hire it?

21. (*If hunter*) From where/whom do you get your cartridges?
Do you buy them, are they a present or are they given as credit?
How much do they cost?

22. (*If trapper*) From where/whom do you get your wire for snares?
Do you buy it, is it a present or is it given as credit?
How much does it cost?

23. Do you want your sons to become hunters too?

(Questions 24-26 probably only need be asked for the first few interviews.)

24. Does everyone have free access to the forest?
Including people who do not live in Sendje?

25. Who owns the forest?

26. Are there any restrictions against hunting (for example by the community or another authority)?
Do people need permission to hunt?
Are there any seasons when hunting is not permitted?

APPENDIX 3

This is an English translation (from Spanish) of the final trader interview. Directions for the interviewer are given in italics.

TRADER INTERVIEW

Interviewers:	Date:
Trader name:	Location:
Age:	<i>(If live in Sendje)</i> Household code/head:
Sex:	<i>(If don't live in Sendje)</i> Permanent residence:

1. Products traded

- 1.1 What products do you buy from Sendje? (e.g. bushmeat, meat from domestic animals, fish, eggs, crops, etc.)
- 1.2 What proportion of each?
- 1.3 Can you put each type of product in order of importance?

2. Regularity of trade

- 2.1 How many years have you been trading in products/bushmeat?
- 2.2 Do you buy products/bushmeat from Sendje every day?
(If no) How many days per week do you buy products/bushmeat from Sendje?
Which days?
Why?
Is it the same type and proportion of products/bushmeat each time?
- 2.3 Are there any days that you buy/sell more or less products/bushmeat?
Are there any months/seasons that you buy/sell more or less products/bushmeat?
- 2.4 Are there more or less animals available to buy than when you started trading?
- 2.5 Are there any species that are more easily available than others? Or more easily available in different months/seasons?

3. *Quantity and type of bushmeat traded*

- 3.1 Do you prefer to buy/sell particular products/species? (e.g. bushmeat, meat from domestic animals, fish, eggs, crops etc.)
Which ones?
Why?
- 3.2 Of the animals/meat that you trade, which species are most profitable?
- 3.3 Do you buy more whole or part animals?
What proportion of each?
Why?
- 3.4 Do you buy more fresh, singed or smoked animals?
What proportion of each?
Why?
- 3.5 Do you sell more whole or part animals?
What proportion of each?
Why?
- 3.6 Do you sell more fresh, singed or smoked animals?
What proportion of each?
Why?

4. *Price*

- 4.1 How much do you pay for each species and how much do you sell them for? (*Go through species picture cards with trader one by one.*)
- 4.2 How much do they sell for in Bata?
Is this in the market or to wholesalers or restaurants?
Is the price the same for all buyers?
- 4.3 Are there any species that are more or less expensive to buy since you started trading?
Which ones?
Why?
- 4.4 Are there any species that are more or less expensive to sell since you started trading?
Which ones?
Why?

5. Trade

- 5.1 To whom do you sell your products/bushmeat?
Do you have many buyers?
If you sell to a market, which one is it?
Do you always sell to the same market trader or restaurateur?
- 5.2 Where do you sell your meat?
- 5.3 Do they pay you credit (so that you can buy products/bushmeat from the villagers/hunters?)
- 5.4 Do you request particular products/species from the villagers/hunters?
(If yes) What/which?
Why?
- 5.5 Do you pay any hunters to hunt exclusively for you?
(If yes) Do you pay them credit (so that they can buy equipment for hunting/trapping, e.g. guns/cartridges/wire etc.)?
Do you provide any hunters with equipment for hunting/trapping (e.g. guns/cartridges/wire etc.)?
- 5.6 Do you buy products/bushmeat from any other places besides Sendje?
(If yes) From where?
What proportion of your products/bushmeat is from Sendje?

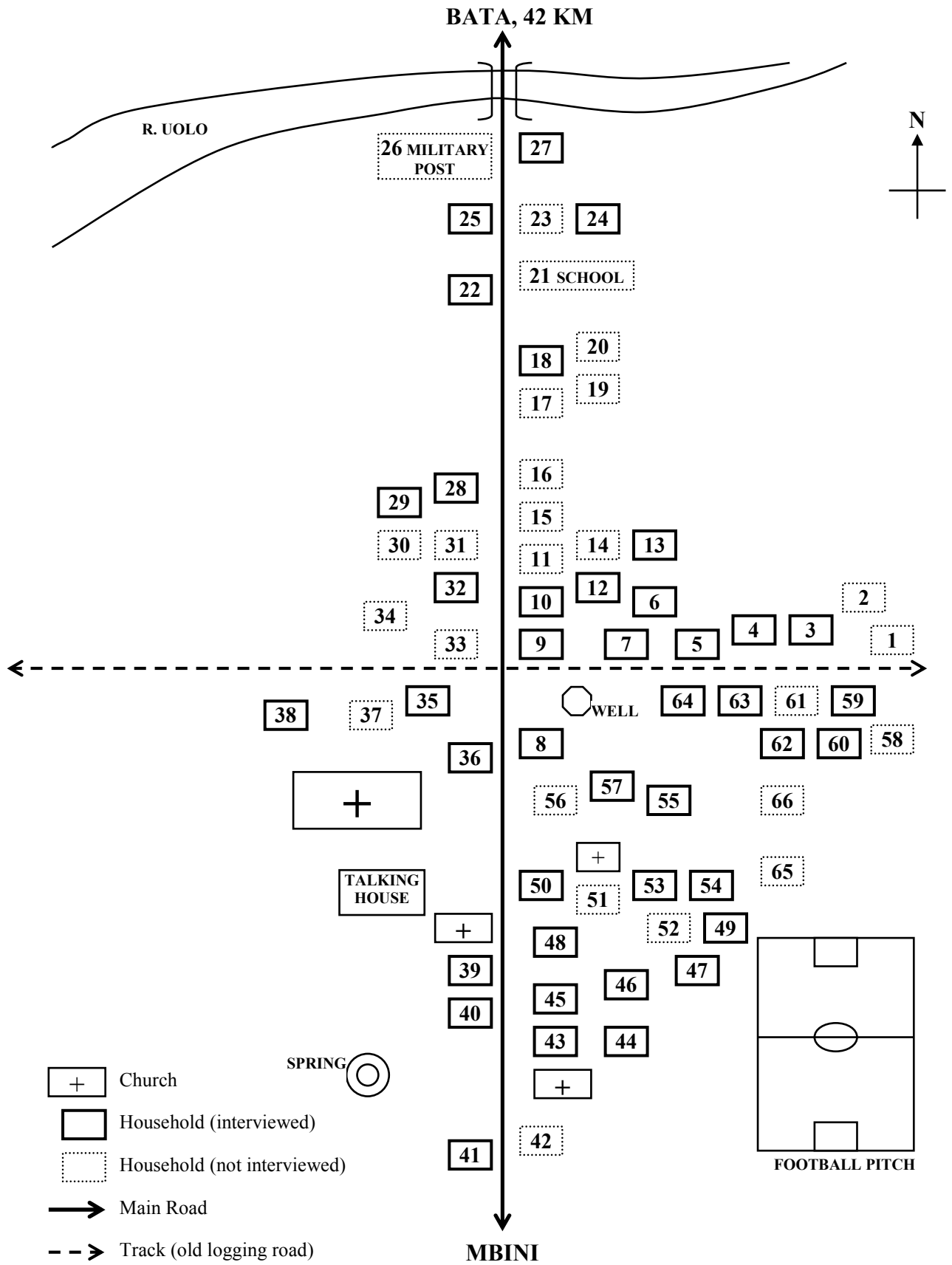
6. Transport

- 6.1 How do you transport your products/bushmeat to market?
- 6.2 Do you pay for the transport?
How (e.g. in money or in products/meat)?
Do you pay by weight, size or number of products/animals?
Do all products/species cost the same?

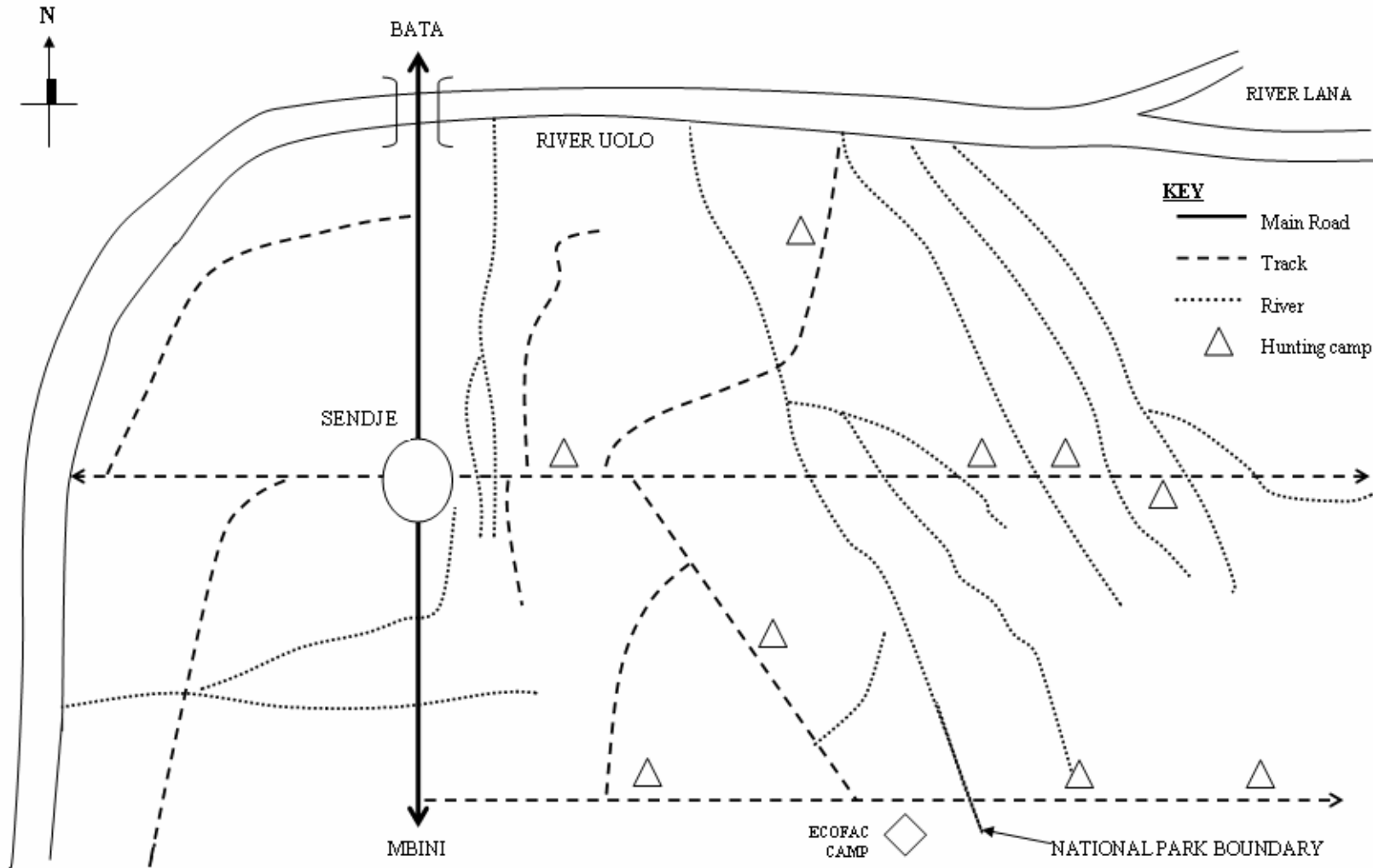
7. Legality and enforcement

- 7.1 Is it possible to trade freely in bushmeat?
(If no) Why not?
- 7.2 Is permission required?
Do you have to pay the authorities in order to be able to trade?
(If yes) Who do you have to pay?
How much?
- 7.3 Do many people worry about being punished for trading in bushmeat?

APPENDIX 4 – Village Map



APPENDIX 5 – Map of Surrounding Area



APPENDIX 6

A record of the prices for all of the foods (meat and fish) available in the village. This is the same list of foods used in the household interview (Appendix 1). The prices were obtained from personal observation and discussion with a research assistant and hunter.

Meat / fish	¹ Unit	² State	³ Price (CFA francs)	⁴ Source	⁵ Notes
Small antelope	W	F	3500-4000	S	Blue duiker
	W	S	2000-2500	S	
Large antelope	W	S	1500-2000	S	All antelopes other than blue duiker
Buffalo	kg	F	1000	S	
Elephant	kg	F	500-1000	S	Rarely available
Wild pig	W	F	30,000-40,000	S	Usually sold to trader
Gorilla	W	F	>20,000	B	Sold to trader; not eaten in the village
Chimpanzee	W	F	>20,000	B	Sold to trader; not eaten in the village
Monkey	W	F	3000-5000	S	Large mandrills more expensive
Wild bird	W	F	1000-1500	S	Guinea fowl, plantain-eater + hornbill
Squirrel	W	F	200-1000	S	Rarely sold
Crocodile	W	F	10,000-30,000	S+B	Dwarf crocodile (most common)
Monitor lizard	W	F	1000 (3000)	S (B)	
Wild cat	kg	F	500-1000	S	Skins sold + whiskers (Fang medicine)
Cane rat	W	F	4000-5000	S	
Genet / linsang	W	F	Not sold	S	
Mongoose	W	F	Not sold	S	
Palm civet	W	F	3000	S	
Porcupine	W	F	5000	S	
	W	S	3000	S	
Pangolin	W	F	1,500-3000	S	Tree and long-tailed
	W	F	25,000-40,000	S	Giant
Frog	W	F	n/a	S	Only <i>R. goliat</i> is caught and never sold
Rat	W	F	500-1000	S	Rarely sold
Snail	B	F	500-1000	S	Not as common in Sendje as elsewhere
Snake	kg	F	500	S	Only pythons are eaten, skins sold.
Tortoise	W	F	500-1500	S	
Goat/sheep	W	F	20,000-25,000	S	
Pig	W	F	15,000-20,000	B	Much more common in Niefang
	kg	F	2500	B	
Beef	kg	F	2500	B	Imported
Tinned meat	kg	T	2000-2700	S+B	Cooked, processed meat
Chicken	W	F	2000-3000	S	Cockerels are most expensive
	W	H	1200-1500	E	
Duck	W	F	5000	S	
Crab	W	F	100	S	Freshwater, sold in multiples
Fish	kg	F	1000	S	
	W	D	200-2500	S	
	kg	H	700 (800)	B (E)	Imported
	125g	T	300	S	Sardines - imported
Shrimp	kg	F	1500	S	Freshwater, sold in multiples

¹Units: W = whole animal; B = bunch.

²State: F = fresh; S = smoked; T = tinned; H = frozen; D = dried.

³Price: 700 CFA francs = \$1.00.

⁴Source: S = Sendje; B = Bata; E = 'economato' (shop in construction company's camp in Sendje II)

⁵Notes: extra details offered by respondents.

APPENDIX 7

The table shows how often, in relative terms, different bushmeat species are caught and by which hunting method(s). It also shows how likely it is for a particular species to be sold by the hunters. The data is from the Hunter Interviews (Appendix 2).

Explanation of the table:

1. The animals listed are those discussed with respondents in the hunter interview (Appendix 2). Names follow Kingdon (2001). Composition of the list is based on conversations with hunters and the off-take record from Sendje in Fa and Garcia Yuste (2001).
2. *Denotes species included in the list that are not known to be found in Equatorial Guinea.
3. **Scores** are derived from hunters' responses (n = 18) to Question 12 of the Hunter Interview (Appendix 2) and give a relative value for how many animals of each species are shot (**Sh**), trapped (**Tr**) or caught by other means (**Oth**). The score is calculated as follows:

$$\text{Score} = [2 * (\text{no. hunters who capture the animal 'a lot'})] + (\text{no. hunters who capture the animal 'a little'})]$$

4. **% Sold** is derived from the responses to Question 17 of the Hunter Interview (Appendix 2) and gives a mean value for the proportion of captured animals of a particular species that a hunter is likely to sell. The calculation is demonstrated below for the black colobus. Note that only those hunters who capture black colobus responded (n = 12).

<i>Choice of responses</i>	<i>No. of responses</i>	Multiple	Result	% Sold
1) All	9	*1.00	9.00	(10 / 12)*100 = 83%
2) More than half	1	*0.75	0.75	
3) About half	0	*0.50	0.00	
4) Less than half	1	*0.25	0.25	
5) None	1	*0.00	0.00	
SUM	12		10.00	

Group	Common name	Latin name	Scores			% Sold
			Sh	Tr	Oth	
Primates	Allen's squirrel galago	<i>(Galago alleni)</i>	0	3	0	0
	Black colobus	<i>(Colobus satanus)</i>	14	5	0	83
	Chimpanzee	<i>(Pan troglodytes)</i>	0	4	0	75
	Crowned monkey	<i>(Cercopithecus pogonias)</i>	7	3	0	82
	De Brazza's monkey	<i>(Cercopithecus neglectus)</i>	5	1	0	50
	* Dwarf galago	<i>(Galagoides spp)</i>	0	3	0	0
	Elegant needle-clawed galago	<i>(Euoticus elegantulus)</i>	0	1	0	0
	Golden angwantibo	<i>(Arctocebus aureus)</i>	0	4	0	50
	Gorilla	<i>(Gorilla gorilla)</i>	2	2	0	75
	Grey-cheeked mangabey	<i>(Lophocebus albigena)</i>	2	2	0	50
	Mandrill	<i>(Mandrillus sphinx)</i>	7	15	0	75
	Moustached monkey	<i>(Cercopithecus cephus)</i>	13	7	0	88
	Northern talapoin	<i>(Miopithecus gouensis)</i>	5	6	0	36
	Potto	<i>(Perodicticus potto)</i>	1	9	0	17
	Putty-nosed monkey	<i>(Cercopithecus nictitans)</i>	13	5	0	90
	Red colobus	<i>(n/a)</i>	0	2	0	100
	Red-capped mangabey	<i>(Cerocebus torquatus)</i>	6	1	0	100
Ungulates	African buffalo	<i>(Syncerus caffer)</i>	0	7	0	38
	Bay duiker	<i>(Cephalophus dorsalis)</i>	0	19	0	72
	Black-fronted duiker	<i>(Cephalophus nigrifrons)</i>	0	8	0	100
	Blue duiker	<i>(Cephalophus monticola)</i>	1	17	0	74
	Bongo	<i>(Tragelaphus euryceros)</i>	0	1	0	100
	Bushbuck	<i>(Tragelaphus scriptus)</i>	0	6	0	88
	* Common warthog	<i>(Phacochoerus africanus)</i>	0	0	0	0
	Dwarf antelope	<i>(Neotragus batesi)</i>	0	3	0	100
	Giant hog	<i>(Hylochoerus meinertzhageni)</i>	0	1	0	100
	Hippopotamus	<i>(Hippopotamus amphibius)</i>	0	0	0	0
	Ogilby's duiker	<i>(Cephalophus ogilbyi)</i>	0	16	0	84
	Peter's duiker	<i>(Cephalophus callipygus)</i>	0	17	0	81
	Red river hog	<i>(Potamochoerus porcus)</i>	0	16	0	58
	Sitatunga	<i>(Tragelaphus spekei)</i>	3	11	0	61
	Water chevrotain	<i>(Hyemoschus aquaticus)</i>	0	15	0	86
	White-bellied duiker	<i>(Cephalophus silvicultor)</i>	0	11	0	81
	* Wild boar	<i>(Sus scrofa)</i>	0	5	0	94
Yellow-backed duiker	<i>(Cephalophus silvicultor)</i>	0	13	0	50	
Elephants	African elephant	<i>(Loxodonta africana)</i>	0	0	0	0
Pangolins	Giant pangolin	<i>(Smutsia gigantea)</i>	1	17	0	89
	Long-tailed pangolin	<i>(Uromanis tetradactyla)</i>	0	13	0	68
	Tree pangolin	<i>(Phataginus tricuspis)</i>	1	19	0	70
Rodents	African giant squirrel	<i>(Protoxerus stangeri)</i>	0	11	0	0
	Brush-tailed porcupine	<i>(Atherurus africanus)</i>	1	19	0	77
	Giant pouched rat	<i>(Cricetomys spp)</i>	0	18	0	25
	Green squirrel	<i>(Paraxerus poensis)</i>	0	7	0	0
	Lady Burton's rope squirrel	<i>(Funisciurus isabella)</i>	0	11	0	0
	Savannah cane rat	<i>(Thryonomys swinderianus)</i>	0	15	0	45
Hyraxes	Tree hyrax	<i>(Dendrohyrax dorsalis)</i>	0	17	0	0

Carnivores	African civet	(<i>Civettictis civetta</i>)	0	19	0	0
	African palm civet	(<i>Nandinia binotata</i>)	2	21	0	65
	Black-legged mongoose	(<i>Bdeogale nigripes</i>)	0	14	0	17
	Blotched genet	(<i>Genetta tigrina</i>)	0	17	0	14
	Central African linsang	(<i>Poiana richardsoni</i>)	0	11	0	0
	Cusimanse	(<i>Crossarchus obscurus</i>)	0	22	2	0
	Golden cat	(<i>Felis aurata</i>)	0	3	0	0
	Leopard	(<i>Panthera pardus</i>)	0	4	0	13
	Long-snouted mongoose	(<i>Herpestus naso</i>)	0	20	0	9
	* Servaline genet	(<i>Genetta servalina</i>)	0	16	0	9
	Slender mongoose	(<i>Herpestes sanguinea</i>)	0	9	0	13
	Spot-necked otter	(<i>Lutra maculicolis</i>)	0	2	0	0
	Wild cat	(<i>Felis sylvestris</i>)	0	0	0	0
	Reptiles	Crocodile	(<i>Osteolaemus tetrapsis</i>)	0	9	5
Nile monitor		(<i>Varanus niloticus</i>)	0	17	0	60
Snake		(<i>Python sebae</i>)	0	4	2	0
Tortoise		(<i>Kynixis erosa</i>)	0	13	11	63
Amphibians	Frog	(<i>Rana goliat</i>)	0	0	4	0
Molluscs	Snails	(<i>Achatina spp</i>)	0	2	13	0
Fish	Fish	(<i>n/a</i>)	0	4	11	36
Birds	Black-casqued hornbill	(<i>Ceratogymna atrata</i>)	5	0	0	0
	Blue plantain-eater	(<i>Corythaecola cristata</i>)	5	4	0	35
	Eagle	(<i>n/a</i>)	2	0	0	0
	Grey parrot	(<i>Psittacus erithacus</i>)	0	1	0	100
	Latham's francolin	(<i>Francolinus lathamii</i>)	4	11	2	31

APPENDIX 8

A summary of animals observed on sale as bushmeat at the central market in Bata showing the relative abundance of different species and the range of different conditions they were found in. Names follow Kingdon (2001).

Group	Species	No. ¹	Fr	Sm	Si	Li	Wh	Pt
Primates	Mandrill	<i>Mandrillus sphinx</i>	+		X		X	
	Moustached monkey	<i>Cercopithecus cephus</i>	+++	X	X	X	X	X
	Putty-nosed monkey	<i>Cercopithecus nictitans</i>	+++	X	X	X	X	X
	Black colobus	<i>Colobo satanus</i>	++	X	X		X	
Ungulates	Blue duiker	<i>Cephalophus monticola</i>	+++	X	X	X		X
	Red duikers	<i>Species not determined</i>	+++	X	X	X	X	X
	Yellow-backed duiker	<i>Cephalophus sylvicultor</i>	+	X			X	
	Sitatunga	<i>Tragelaphus spekei</i>	++	X		X	X	X
	Red river hog	<i>Potamochoerus porcus</i>	+	X			X	X
Rodents	Brush-tailed porcupine	<i>Atherurus africanus</i>	+++	X	X		X	
	Giant pouched rat	<i>Cricetomys emini</i>	++	X	X		X	
	Marsh cane-rat	<i>Thryonomys swinderianus</i>	++	X	X		X	
Carnivores	African palm civet	<i>Nandinia binotata</i>	+	X			X	
	African civet	<i>Civettictis civetta</i>	+	X			X	
Pangolins	Tree pangolin	<i>Phataginus tricuspis</i>	++	X	X		X	
Birds	Blue plantain-eater	<i>Corythaeola cristata</i>	+	X			X	
	Black-casqued hornbill	<i>Ceratogymna atrata</i>	+	X			X	
Snails	African Giant Snail	<i>Achatina spp</i>	++	X		X	X	
Reptiles	Tortoise	<i>Species not determined</i>	++	X		X	X	
	Short-nosed crocodile	<i>Osteolaemus tetrapis</i>	+++	X		X	X	
	Nile monitor lizard	<i>Varanus niloticus</i>	+	X			X	

Notes

- ¹ +++, very common and numerous; ++, quite common and numerous; +, rare and few.
- 'X' denotes the range of different conditions the animals were found in:
 - Fr:** fresh (dead but not treated in any way).
 - Sm:** smoked (mere speculation as to what species were smoked!).
 - Si:** singed (burnt hairs scraped off).
 - Li:** live (larger animals tethered or bound).
 - Wh:** whole (may be cut up before being sold for the larger animals).
 - Pt:** part (cut up into portions for sale: heads, limbs, flanks etc.)

APPENDIX 9

Consumption frequency

- ◆ The table records the results from question ‘m’ in the household interview (Appendix 1). The figures refer to the number of households that responded as indicated so, for example, four households ate frozen fish every day. The ‘Total’ refers to the total number of households that gave a response to the question.
- ◆ For a better description of the foods listed see Appendix 6
- ◆ Each food type has a score that reflects the mean frequency with which that food is eaten. These scores have been ranked. The scores are calculated as follows:

$$\text{Score} = ((\text{daily}/\text{total}) * 5) + ((\text{weekly}/\text{total}) * 4) + ((\text{monthly}/\text{total}) * 3) + ((\text{rarely}/\text{total}) * 2)$$

e.g. $\text{Score}(\text{frozen fish}) = ((4/39) * 5) + ((18/39) * 4) + ((4/39) * 3) + ((13/39) * 2) = 3.33$

Food	Frequency with which each food is eaten					Total	Score	Rank (score)
	daily	weekly	monthly	rarely	never			
Frozen fish	4	18	4	13		39	3.33	1
Fresh fish	6	7	10	15	1	39	3.03	2
Dried fish	3	9	8	19		39	2.90	3
Frozen fish	1	10	11	16	1	39	2.82	4
Small antelope	2	7	12	18		39	2.82	4
Tinned fish	2	10	8	18	1	39	2.82	4
Shrimp	2	7	9	21		39	2.74	7
Rat	2	8	7	21	1	39	2.69	8
Porcupine		6	8	24	1	39	2.46	9
Crab	1	4	8	25	1	39	2.44	10
Monkey		2	11	24	2	39	2.28	11
Pangolin		2	10	25	2	39	2.26	12
Fresh chicken	1		2	36		39	2.13	13
Large antelope			5	31	3	39	1.97	14
Duck			2	35	2	39	1.95	15
Tortoise		1	5	28	5	39	1.92	16
Palm civet			4	31	4	39	1.90	17
Genet / linsang		1	2	32	4	39	1.90	17
Goat / sheep			2	34	3	39	1.90	17
Beef	1		4	28	6	39	1.87	20
Cane rat			3	32	4	39	1.87	20
Buffalo				36	3	39	1.85	22
Crocodile			3	31	5	39	1.82	23
Tinned meat	1		3	28	7	39	1.79	24
Wild pig				35	4	39	1.79	24
Wild bird		1	1	31	6	39	1.77	26
Snail		1	4	26	8	39	1.74	27
Elephant				34	5	39	1.74	27
Pig				27	12	39	1.38	29
Monitor lizard		1		21	17	39	1.18	30
Cat			1	21	17	39	1.15	31
Squirrel				20	19	39	1.03	32
Mongoose				20	19	39	1.03	32
Frog			1	14	24	39	0.79	34
Snake				14	25	39	0.72	35
Chimpanzee				9	30	39	0.46	36
Gorilla				4	35	39	0.21	37

Price perception

- ◆ The table records the results from question ‘o’ in the household interview (Appendix 1). The figures refer to the number of households that responded as indicated so for example, thirty-nine households think that wild pig is very expensive (1 = very expensive, 2 = quite expensive, 3 = neither expensive nor cheap, 4 = quite cheap, 5 = very cheap). The ‘Total’ refers to the total number of households that gave a response to the question.
- ◆ For a better description of the foods listed see Appendix 6.
- ◆ Each food type has a score that reflects the mean perceived price for that food. These scores have been ranked. The scores are calculated as follows:

$$\text{Score} = ((\text{v.expensive}/\text{total}) * 5) + ((\text{quite expensive}/\text{total}) * 4) + ((\text{neither expensive nor cheap}/\text{total}) * 3) + ((\text{quite cheap}/\text{total}) * 2) + ((\text{very cheap}/\text{total}) * 1)$$

e.g. $\text{Score}(\text{wild pig}) = ((39/39) * 5) + ((0/39) * 4) + ((0/39) * 3) + ((0/39) * 2) + ((0/39) * 1) = 5.00$

Food	Perceived price of foods					Total	Score	Rank (score)
	1	2	3	4	5			
Wild pig	39					39	5.00	1
Crocodile	38	1				39	4.97	2
Goat / sheep	37	2				39	4.95	3
Large antelope	37	1		1		39	4.90	4
Buffalo	34	3	1			38	4.87	5
Pig	35	2			1	38	4.84	6
Porcupine	35	2	1	1		39	4.82	7
Pangolin	34	1	2	1	1	39	4.69	8
Beef	34	2		2	1	39	4.69	8
Duck	29	6		2	1	38	4.58	10
Chimpanzee	20	2		2	1	25	4.52	11
Small antelope	30	4	2	1	2	39	4.51	12
Monkey	27	7	2	2	1	39	4.46	13
Wild cat	25	1	1		4	31	4.39	14
Gorilla	20	1		1	3	25	4.36	15
Palm civet	26	4		2	4	36	4.28	16
Cane rat	27	3		3	4	37	4.24	17
Fresh fish	23	7	2	5	1	38	4.21	18
Elephant	28	2	1	3	5	39	4.15	19
Frozen chicken	21	9	3	3	3	39	4.08	20
Fresh chicken	20	9	4	1	4	38	4.05	21
Tinned meat	23	6	1	2	7	39	3.92	22
Shrimp	25	1	3		9	38	3.87	23
Monitor lizard	21	3	1	2	7	34	3.85	24
Genet / linsang	20	2	1	3	9	35	3.60	25
Snake	16	1		1	11	29	3.34	26
Frozen fish	16	5	2	7	9	39	3.31	27
Tortoise	17	5	1	3	13	39	3.26	28
Dried fish	13	4	4	6	9	36	3.17	29
Mongoose	13	2	1	4	12	32	3.00	30
Frog	12		1	1	14	28	2.82	31
Tinned fish	13	2	1	6	17	39	2.69	32
Wild bird	11	2	3	4	16	36	2.67	33
Crab	11	2	3	1	19	36	2.58	34
Rat	11	2	2	4	19	38	2.53	35
Snail	10	1	1	3	19	34	2.41	36
Squirrel	6	2			25	33	1.91	37

Taste preference

- ◆ The table records the results from question ‘p’ in the household interview (Appendix 1). The figures refer to the number of households that responded as indicated so for example, twenty-six households love to eat fish. The ‘Total’ refers to the total number of households that gave a response to the question.
- ◆ For a better description of the foods listed see Appendix 6.
- ◆ Each food type has a score that reflects the mean taste preference for that food. These scores have been ranked. The scores are calculated as follows:

$$\text{Score} = ((\text{love}/\text{total}) * 5) + ((\text{like}/\text{total}) * 4) + ((\text{quite like}/\text{total}) * 3) + ((\text{dislike}/\text{total}) * 2) + ((\text{detest}/\text{total}) * 1)$$

e.g. Score(fresh fish) = $((26/37) * 5) + ((11/37) * 4) + ((0/37) * 3) + ((0/37) * 2) + ((0/37) * 1) = 4.70$

Food	Taste preference					Total	Score	Rank (score)
	love	like	q. like	dislike	detest			
Fresh fish	26	11				37	4.70	1
Fresh chicken	15	18	3	1		37	4.27	1
Frozen chicken	4	17	8	8		37	3.46	1
Porcupine	24	13				37	4.65	2
Goat / sheep	4	25	6	2		37	3.84	2
Beef	6	21	5	4	1	37	3.73	2
Duck	6	19	8	4		37	3.73	2
Pangolin	23	14				37	4.62	3
Shrimp	13	22	1	1		37	4.27	3
Wild Pig	22	14	1			37	4.57	4
Tinned meat	3	16	10	6	2	37	3.32	4
Crocodile	23	11		1	2	37	4.41	5
Crab	6	20	7	4		37	3.76	5
Dried fish	2	23	9	3		37	3.65	5
Pig	5	14	9	7	2	37	3.35	5
Cane rat	13	19		2	1	35	4.17	6
Monkey	10	21	3	3		37	4.03	6
Palm civet	10	20	4		2	36	4.00	6
Rat	2	25	8		1	36	3.75	6
Frozen fish	2	16	17	2		37	3.49	6
Small antelope	11	22	3	0	1	37	4.14	9
Tinned fish	2	14	14	6	1	37	3.27	9
Elephant	4	24	6	2	1	37	3.76	11
Tortoise	5	17	6	1	6	35	3.40	11
Large antelope	4	24	5	2	1	36	3.78	12
Gent / linsang	5	19	3	3	4	34	3.53	13
Snake		8		4	21	33	1.85	15
Frog	13		2	4	15	34	2.76	16
Wild bird	1	26	6	2	1	36	3.67	18
Buffalo	7	18	6	4	2	37	3.65	18
Mongoose	1	8	5	6	13	33	2.33	20
Wild cat	4	17	2	2	10	35	3.09	23
Snail	2	19	6	6	3	36	3.31	24
Monitor lizard	2	8	1	5	18	34	2.15	24
Gorilla		1		1	29	31	1.13	27
Chimpanzee		6	2	3	21	32	1.78	30
Squirrel		14	4	6	10	34	2.65	31

