



## Offtake Numbers at 5-Yearly Intervals over a 10 Year-Period in the Catchment Area of a Rural Bushmeat Market, Rivers State, Nigeria

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### Authors' contributions

This work was carried out in collaboration among authors. Author SNO designed the study, supervised the 1<sup>st</sup> collection, author MAEN supervised the 2<sup>nd</sup> collection and author SON supervised the 3<sup>rd</sup> collection. Author MAEN managed the literature search and wrote the first draft. Author SNO analyzed the data and wrote the final draft of the manuscript. All authors read and approved the final manuscript.

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### ABSTRACT

The first step in making the exploitation of wildlife more sustainable is to determine the sustainability of current levels of harvest. This has two components: determining the offtake from an area; determining the effect this offtake has on the species concerned. Investigations were undertaken over a 10-year period (2005, 2009, 2014) to monitor offtake numbers at 4-6 year intervals and their effects on species concerned in the catchment area of a rural bushmeat market. The area was approximately 105km<sup>2</sup>, in lowland rainforest, dominated by secondary vegetation and fragmented by farms. Carcasses of hunted wildlife were identified in early rainy season (May-June) in each of the three years (2005, 2009, 2014). Detailed keys were used for identification. Carcasses were identified and counted daily; weekly totals were pooled and monthly totals obtained. Monthly totals for May and June in each year were added. From 2005 to 2009, there were 2-12 fold increases in number of most species. The greatest increase was in *Thyromomus swinderianus*. Between 2009 and 2014, there were 2-10 fold increases in number of most species;

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the highest increases were in *Xerus erythropus* and *Cercopithecus mona*. There were 50-75% decreases in a few species (*Genetta poensis*, *Cephalophus maxwelli*, *Thyonomus swinderianus*, *Numida melagris galeata*) during the period. There were no significant differences in total numbers of offtakes among the three years ( $P=0.3989>5\%$  significant level). Differences in numbers for each species among the three years were significant ( $P=0.002<5\%$  significant level). The differences in the relative proportions among species in the three years were significant ( $P=0.016<5\%$  significant level). Differences in total numbers among years were not significant and offtakes did not lead to very low numbers or cause local extinction.

**Keywords:** *Offtake rates; exploitation; sustainability; conservation; Nigeria.*

## 1. INTRODUCTION

Wildlife is an important livelihood asset for the poor. It is also a regional public good, since it has the characteristic of being a cross-border benefit, shared by more than one country. The global public good of wildlife is anchored on the option values preserved in biological diversity [1,2]. Positive linkages exerted by wild animals on food production systems include animals as seed dispersal and population agents and wild animal droppings as fertilizers [3].

Wildlife populations in a sizable number of African countries declined in the 1970s and 1980s as a result of a combination of hunting pressure, development, drought, habitat change and disease [4]. Bush meat continues to be a significant source of protein consumed in many African countries. Bennett et al. [5] estimated that wild meat provides more than 50% of protein for many forest peoples. Ashby and Child [6] reported that bush meat supplied up to 84% of protein in some areas of Nigeria, 70% in Liberia and 60% in Botswana. Bush meat is cheaper than domestic meat in rural areas thus it is particularly accessible to the poor [7]. Overexploitation by human hunters is responsible for the decline in one-third of all mammal and bird species threatened with extinction [8]. Such hunting is generally utilitarian in nature [9] and is most serious in tropical forests where wildlife is harvested as bush meat [5]. Attempts to substitute farmed domestic species for bush meat in forested areas have not met with success. Domestication of key bush meat species has similarly met with economic, technical and livelihood obstacles [1].

Over the recent years, a growing number of studies have described bush meat harvesting as unsustainable [10], particularly in Africa, where the volume of extraction is exceptionally high [11]. The control of unsustainable bush meat

hunting is a high priority for international conservation. The urgency and importance of achieving this goal is further emphasized by the role that bushmeat plays in the livelihoods of poor rural populations across the tropics [12,13]. Evaluating the sustainability of hunting is key to the conservation of species exploited for bush meat; researchers are often hampered by a lack of basic biological data on species [14]. The first step in making the exploitation of wildlife more sustainable is to determine the sustainability of current levels of harvest. This has two aspects: (1) determining the offtake from an area, and (2) determining the effect that this offtake has on the species concerned [14]. In order to determine that the exploitation of wildlife from the catchment area of a rural bush meat market was sustainable, offtake numbers were monitored over a 10-year period at about 5- yearly intervals.

## 2. MATERIALS AND METHODS

The study area is approximately 105km<sup>2</sup> and the bush meat market is located in the southeast, along the interstate road that connects two capitals, Port Harcourt (Rivers State) and Owerri (Imo State). The area lies in the lowland rainforest, dominated by secondary vegetation and fragmented by farms. More details are provided in earlier studies [15-17]. The Omagwa market is the main center for the sale of almost all the wildlife killed within the catchment area. Collections were made in the early rainy season (May-June). The detailed keys of Happold [18] and Kingdon [19] were used for the identification of wildlife. Data on numbers of different species brought to the market were collected daily; at the end of the day, after counting the unsold carcasses were dismembered, smoked and sold. Weekly numbers were pooled and monthly totals obtained. The sums of the 2 monthly-totals, collected over 61 days, were obtained for each of the years: 2005, 2009, 2014. These records for the various years appear in Table 1.

### 3. RESULTS

Between 2005 and 2009, there were approximately 2-fold increases in the numbers of *Genetta poensis*, *Potamochoerus porcus*, *Xerus erythropus*, *Atherurus africanus*; 3-fold increases in *Tragelaphus sekei*, *Nandina binotata*, *Cercopithecus mona*; 6-fold increase in *Cephalophus maxwelli* and a 12-fold increase in *Thyronomus swinderianus* (Table 1). Between 2009 and 2014, there were approximately 2-fold increases in *Nandina binotata*, *Potamochoerus porcus*; 4-fold increases in *Tragelaphus sekei*; 10-fold increases in *Xerus erythropus*, *Cercopithecus mona*, approximately 50% decreases in *Thyronomus swinderianus*, *Numida meleagris galeata*; and 75% decreases in *Genetta poensis*, *Cephalophus maxwelli* (Table 1). There were no significant differences in total numbers of carcasses among the three years (2005, 2009, 2014) ( $p=0.3989 > 5\%$  significant level). Differences in numbers for each species among the three years (2005, 2009, 2014) were significant ( $p=0.002 < 5\%$  significant level). The differences in the relative proportions among species in the three years (2005, 2009, 2014) were significant ( $p=0.016 < 5\%$  significant level).

### 4. DISCUSSION

Generally, there was a steady increase in offtake numbers of all species within the initial four years of the study, the most dramatic were those of the Greater Cane Rat, *T. swinderianus* that increased (200%) and *C. maxwelli*, Maxwell's duiker that increased (500%). The resilience of

the Greater Cane Rat has been attributed to several factors: including high reproductive rate, short gestation period [18], abundance of favoured plants [16]; evolutionary adaptation, leading to an increase in recruitment (increase in litter size) [20]. Since Maxwell's duikers have slow breeding rates, a gestation period of 120 days and three years to attain maturity [18], consequently, the high number of *C. maxwelli* offtake within the first four years was probably due to increased effort, targeting the species. Similarly, the meteoric rise in numbers of Mona Monkey and Situanga offtakes during the second half of the study was probably due to intensified effort, since these are slow breeders, with gestation periods of about six months [18]. Furthermore, this period coincided with a major road construction and habitat loss. In contrast, the significant increases in numbers of ground squirrel, 2009-2014 could be ascribed to a combination of high reproductive rate and intensified effort. Over the 10 year- period only one species, Crested Genet, decreased, between 2005 (68) and 2014 (54), and the IUCN has classified Genets as threatened [21]. The harvesting rates of slow breeders (Mona Monkey, Situanga, Red River Hog, Maxwell's Duikers) and fast breeders (the Greater Cane Rat, Geoffrey's Ground Squirrel) should be significantly reduced.

Over the 10 year-period, the species diversity of hunted animals was unchanged, differences in total numbers among the three years were not significant, and harvesting did not apparently cause wildlife population to decline to very low

**Table 1. Numbers of carcasses at Omagwa (May-June)**

S. No	Species name		Year of study		
	Common	Scientific	2005	2009	2014
1	Sitatunga	<i>Tragelaphus sekei</i>	65	231	750
2	African Civet Cat	<i>Nandina binotata</i>	89	226	457
3	Greater Cane Rat	<i>Thyronomus swinderianus</i>	356	4160	1975
4	Forest Genet	<i>Genetta poensis /G. cristata</i>	68	179	54
5	Maxwell's Duiker	<i>Cephalophus maxwelli</i>	123	737	187
6	Red River Hog	<i>Potamochoerus porcus</i>	47	92	210
7	Geoffrey's Ground Squirrel	<i>Xerus erythropus</i>	49	99	983
8	Guinea Fowl	<i>Numida meleagris galeata</i>	69	294	170
9	Mona Monkey	<i>Cercopithecus mona</i>	49	136	1246
10	Brush-tailed Porcupine	<i>Atherurus africanus</i>	320	557	608
Totals			2806	7643	6540

Sources: Okiwelu et al., 2008, 2010; Nzeako et al. 2016 [15-17]

numbers or local extinctions. The uncertainties of assessing the sustainability of bushmeat hunting have been extensively discussed [2-4]. Further studies are planned to provide biological data for parameters required by the Robinson and Redford method [22] to assess sustainability.

## 5. CONCLUSION

Although offtake numbers fluctuated over three years, they did not lead to a decline to very low numbers or cause local extinction. However, an assessment of sustainability could not be undertaken because the biological data for parameters required by the Robinson and Redford method were non-existent.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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