

## ANALYSIS OF HUNTERS' RETURN IN THREE MAJOR BUSHMEAT DEPOTS, IN SOUTH-WEST NIGERIA

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**Abstract:** Submissions of game harvested by hunters per expedition to bushmeat landing depots in Southwestern Nigeria were studied for one year. Three established bushmeat landing depots were purposively selected for the study. Olomore and Kila in Ogun State and

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Odo Ona in Oyo State. The three were so selected because of their distribution along almost the same line of geographical placement on a line with Kila falling in between the other two on a line. Hunters' return of harvested game after overnight hunting to the three locations on weekly basis was identified and counted for a year. Twenty-one (21) species of Vertebrates in the class Mammalia, reptiles and birds were returned to the three bushmeat depots by hunters during the study. Location-wise, Olomore had the highest return (1,457) and the least was returned to Kila (987) both in Ogun State. Species-wise, *Thryonomys swinderianus* (Grasscutter) had the highest population of 2,383 animals with a mean value of  $794.3 \pm 180.58$ , followed by *Cephalophus maxwelli* (duiker) with a mean value of  $184.0 \pm 32.51$ . The least hunters' returns were *Bitis gabonica* (Black cobra) and *Perodicticus potto* (Bosmans potto) with a mean value of  $0.33 \pm 0.58$  and  $0.67 \pm 1.15$  respectively.

**Key words:** Nigeria, bushmeat, trade, hunters' return, season, depots

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## INTRODUCTION

In many areas of Central and West Africa, the appetite for bushmeat is so insatiable that hunting levels are thought to be unsustainable for even the faster breeding and relatively common species, such as the smaller duikers (Martins, 1983). Standards for bushmeat processing and marketing vary from one area to another (Ntiamao-Baidu, 1998; Adefalu, Olabanji, Bhadmus, Ibrahim-Olesin, & Kareem, 2021).

On the other hand, the rules are so strict that it is almost impossible to meet the conditions without huge capital investment in abattoirs and cold storage facilities, while on the other hand, there are no rules or standards and the quality of bushmeat offered for sale in the markets varies widely as indicated by (Mendelson, Cowlshaw, & Rowcliffe, 2003; Cowlshaw, Mendelson, & Rowcliffe, 2005).

Bushmeat is eaten as fresh meat, smoked, salted or sun-dried. Smoking is a widespread form of preservation and smoked bushmeat is available in the urban market in most African countries. The protein content of wild meat often 20-25% by weight is comparable to and sometimes higher than that of meat from domestic animals (FAO, 1989; FAO, 1992; Olawepo, Tunde, Malik, & Daudu, 2021). For people in many tropical countries, wildlife killed for consumption is a principal supplemental source of dietary protein (Bennet, 2006; Tătar, et al., 2021).

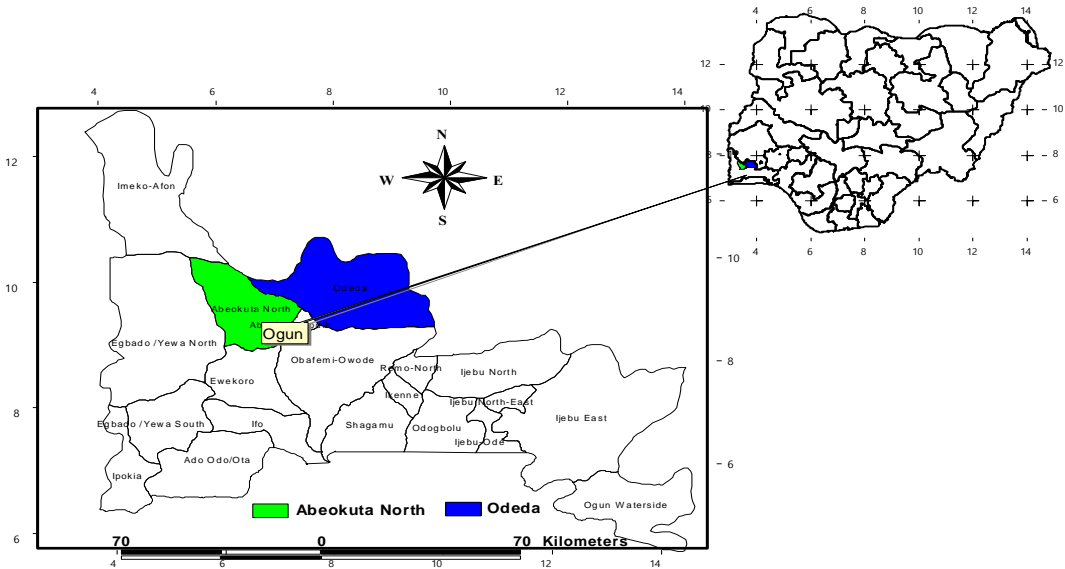
Wild animals eaten vary from rodents, reptiles, monkeys, and a whole range of investment species including snails, beetles and also termites. Rodents are particularly important in terms of the range of species and numbers taken in many parts of Africa because they are not subject to hunting restrictions in many countries and their high reproductive capacity makes them relatively more abundant (Ntiamao-Baidu, 1998; Muntele, 2022). Factors that determine species that are sold or consumed include the size of the animal, cultural inhibition as well as personal or public appeal and demand. This rate of harvest, combined with habitat loss and alteration, has led to very severe population declines (Begon, Mortimer, & Thompson, 1996); if this trend is unchecked, extinction is likely (Bowen-Jones & Pendry, 1999; Babalola, 2023).

Hunting is the practice of pursuing and harvesting wild games for food, recreation, trade or resources. It is also known as regulated and legal hunting when the law is observed and poaching when the killing and trapping of animals is contrary to the law (Wikipedia Encyclopedia, Post Offices - with a map of LGA, Ogun State Census: NIPOST, 2009a). Hunting and gathering of wildlife have always been and continue to be an important aspect of life in rural African societies (Ntiamao-Baidu, 1997; Ibisio, Akani, Nioking, & Glorious, 2021). This is so because the importance of bushmeat to local communities cannot be ignored. Other authors (Lahm, 1996) described how villagers in Gabon have become more dependent on bushmeat because of permanent settlement along roads, replacement of traditional weapons, abandonment of traditional beliefs and participation in a cash economy.

## METHODOLOGY

### Study Area

Three bushmeat landing depots in Oyo and Ogun State were purposively selected for the study because of the numbers and volume of bushmeats that are being processed daily as hunters return to these locations. They are the Olomore bushmeat centre (Olomore) and Kila bushmeat centre (Kila) in Ogun State (Figure 1).



**Figure 1.** Map of Ogun State showing Abeokuta North and Odeda Local Government area where Olomore and Kila bushmeat depots are located. Inset is the map of Nigeria depicting the location of Ogun State (Data source: (Wikipedia Encyclopedia, 2009a))

### Data collection

These depots were routinely visited from Monday to Saturday in two-cycle of Monday to Wednesday and Thursday to Saturday respectively for one year. Each visit lasted for 6 hours between 08.00 hours to 14.00 hours. Data were collected through on-site observation at those centres where hunters deposit their games for sale. Each animal brought to the depots during the visiting hours was identified and classified by its sex and age categories. Thorough visual observation of the external reproductive organs of the animals was used to ascertain the age class. Information was collected from each depot on weekly basis for a year period during which the study lasted. Weekly records of hunters' returns were pooled and sorted on a species basis per depot. All the species encountered within the study areas were categorized using descriptive statistics based on species, sex, and age. Each species returned was ranked with the frequency of killing and analyzed descriptively, and with a one-way analysis of variance as inferential statistics using SPSS software.

## RESULT

### Hunters return during the Wet Season in the three bushmeat depot

A total of twenty (20) species of bushmeat were returned to the three depots surveyed in this study during the wet season. This gave a cumulative figure of 2,110 wild games which comprises Grasscutter (*Thryonomys swinderianus*) as the one with the highest total persecuted population (1439) with an average of  $479.67 \pm 81.53$ . This was followed by Maxwell Duiker (*Cephalophus maxwelli*) (302) with an average population of  $100.67 \pm 13.04$ , Hare (*Lepus capensis*) (87) with an average population of  $29.00 \pm 2.65$ , while Black Cobra (*Naja melanoleuca*) was the least persecuted and returned to the depots by hunters during the wet season (Table 1).

**Table 1.** The population of Animal Species returned to the three depots during Wet Season  
(Data source: Field Survey Calculations)

Animal	Olomore	Kila	Odo Ona	Total	Mean $\pm$ SE
Black Cobra	1	0	0	1	0.33 $\pm$ 0.33
Bushbuck	3	2	7	12	4.00 $\pm$ 1.53
Bush fowl	2	3	4	9	3.00 $\pm$ 0.58
Civet cat	5	2	5	12	4.00 $\pm$ 1.00
Crocodile	2	3	2	7	2.33 $\pm$ 0.33
Duiker	122	77	103	302	100.67 $\pm$ 13.04
Gabon viper	1	1	2	4	1.33 $\pm$ 0.33
Genet cat	11	6	9	26	8.67 $\pm$ 1.45
Giant rat	8	13	16	37	12.33 $\pm$ 2.33
Grasscutter	639	370	430	1439	479.67 $\pm$ 81.53
Ground squirrel	10	6	7	23	7.67 $\pm$ 1.20
Guinea fowl	1	4	4	9	3.00 $\pm$ 1.00
Hare	33	24	30	87	29.00 $\pm$ 2.65
Mona monkey	1	0	1	2	0.67 $\pm$ 0.33
Monitor lizard	16	9	11	36	12.00 $\pm$ 2.08
Pangolin	22	13	24	59	19.67 $\pm$ 3.38
Porcupine	8	8	3	19	6.33 $\pm$ 1.67
Python	3	1	8	12	4.00 $\pm$ 2.08
Shortnose Crocodile	4	1	4	9	3.00 $\pm$ 1.00
Tree hyrax	2	0	3	5	1.67 $\pm$ 0.88
<b>Total</b>	<b>894</b>	<b>543</b>	<b>673</b>	<b>2110</b>	<b>703.33 <math>\pm</math> 102.45</b>

The trend follows the same pattern in the dry season, Twenty species were equally returned to the three depots, with Grasscutter (314.67  $\pm$  23.92) and Maxwell duiker (83.33  $\pm$  6.01) being the first and second highest returned games, while other species of Snakes (Gabon Viper) and Mona monkey were the least persecuted (0.33  $\pm$  0.33 each) and returned animals to these Centres during the dry season (Table 2).

**Table 2.** The population of Animal Species returned to bushmeat depots during the Dry Season  
(Data source: Field Survey Calculation)

Name of Animals	Scientific Name	Olomore	Kila	Odo Ona	Total	Mean $\pm$ SE
Bosman potto	<i>Perodicticus potto</i>	2	0	0	2	0.67 $\pm$ 0.67
Bushbuck	<i>Tragelaphus scriptus</i>	3	0	0	3	1.00 $\pm$ 1.00
Bush fowl	<i>Francolinus bicalcaratus</i>	3	2	0	5	1.67 $\pm$ 0.88
Civet cat	<i>Viverra civette</i>	10	2	5	17	5.67 $\pm$ 2.33
Crocodile	<i>Crocodilus niloticus</i>	0	1	2	3	1.00 $\pm$ 0.58
Duiker	<i>Cephalophus maxwelli</i>	95	75	80	250	83.33 $\pm$ 6.01
Gabon viper	<i>Bitis gabonica</i>	0	0	1	1	0.33 $\pm$ 0.33
Genet cat	<i>Genetta pardina</i>	5	5	3	13	4.33 $\pm$ 0.67
Giant rat	<i>Cricetomys gambianus</i>	12	7	6	25	8.33 $\pm$ 1.86
Grasscutter	<i>Thryonomys swinderianus</i>	362	297	285	944	314.67 $\pm$ 23.92
Ground squirrel	<i>Xerus erythropus</i>	3	3	6	12	4.00 $\pm$ 1.00
Guinea fowl	<i>Numidia meleagris</i>	2	3	1	6	2.00 $\pm$ 0.58
Hare	<i>Lepus capensis</i>	28	25	24	77	25.67 $\pm$ 1.20
Mona monkey	<i>Cercopithecus mona</i>	1	0	0	1	0.33 $\pm$ 0.33
Monitor lizard	<i>Varanus niloticus</i>	18	6	16	40	13.33 $\pm$ 3.71
Pangolin	<i>Manis tricuspis</i>	14	12	19	45	15.00 $\pm$ 2.08
Porcupine	<i>Hystrix cristata</i>	0	3	7	10	3.33 $\pm$ 2.03
Python	<i>Python sebae</i>	2	1	3	6	2.00 $\pm$ 0.58
Shortnose crocodile	<i>Osteolemus tetraspis</i>	2	2	2	6	2.00 $\pm$ 0.00
Tree hyrax	<i>Dendrohyrax dorsalis</i>	1	0	2	3	1.00 $\pm$ 0.58
<b>Total</b>		<b>563</b>	<b>444</b>	<b>462</b>	<b>1469</b>	<b>489.67 <math>\pm</math> 37.03</b>

The quantity of bushmeat returned to various depots seasonally indicated that populations of the persecuted games were higher during the wet season (2,110) than in the dry season (1,469). In both seasons, Olomore had the highest return (894; 563), followed by Odo Ona Kekere (673; 462) and the least was returned to Kila (563; 444) for wet and dry seasons respectively (Tables 1, 2). Annually, twenty-one (21) species of vertebrates were deposited in the three bushmeat depots by the hunters in both States. The grasscutter was still the highest annual persecuted and returned game, followed by Maxwell duiker while Black Cobra, Gabon Viper and Mona Monkey were the least.

### Monthly returns of Animals to the three depots

Seasonally, it was discovered that Olomore had the highest population of wild animals returned (563) during the dry season followed by Odo Ona (462) while the least population of animals were returned to Kila (444), thus a total of 1,469 animals were returned in the dry season. However, within the months of the dry season, the three locations recorded the highest return of Games in November; Olomore (183) Odo Ona (138) and Kila (117) each. The least return in the three landing depots during the months of the Dry season was in January with Olomore (47), Odo Ona and Kila returning 39 games respectively, but within the months that fall into the wet season, records of the highest monthly return vary. For instance, Olomore recorded the highest return (212) in May, While Odo Ona was in June (128) and Kila in September (100). Coincidentally, the least return in the three locations during the wet season was in July, though the same figure was also recorded in March at Olomore. Cumulatively, the highest population of bushmeat were returned to the three locations in November (438). This was followed by June (384) while January (144) had the least returned during the period of study. The highest monthly population of bushmeat was returned to Olomore in May (212) while the least was returned in January (47). However, Odo Ona depots recorded their highest monthly return in June (128) and least return in January (58). Kila also had its highest return in November (138) and least return in January (39) respectively (Table 3).

**Table 3.** Monthly Return of bushmeat by hunters to the three Depots in Oyo and Ogun State  
(Data source: Field Survey Calculations)

Month	Olomore	Kila	Odo Ona	Total	Mean $\pm$ SE
January	47	39	58	144	48.00 $\pm$ 5.51
February	110	110	98	318	106.00 $\pm$ 4.00
<b>March</b>	86	72	85	243	81.00 $\pm$ 4.51
<b>April</b>	112	74	114	300	100.00 $\pm$ 13.01
<b>May</b>	212	82	87	381	127.00 $\pm$ 42.52
<b>June</b>	186	70	128	384	128.00 $\pm$ 33.49
<b>July</b>	86	60	75	221	73.67 $\pm$ 7.54
<b>August</b>	112	85	89	286	95.33 $\pm$ 8.41
<b>September</b>	100	100	95	295	98.33 $\pm$ 1.67
October	92	78	96	266	88.67 $\pm$ 5.46
November	183	138	117	438	146.00 $\pm$ 19.47
December	131	79	93	303	101.00 $\pm$ 15.53
<b>Total</b>	<b>1457</b>	<b>987</b>	<b>1135</b>	<b>3579</b>	<b>1193.00 <math>\pm</math> 138.74</b>

Note: Months that appear in bold prints are those that fall within the wet season.

### Distribution of Individual Animal species in each location

Twenty-one (21) species of Vertebrates in the class, Mammalia; Reptiles and Birds were returned to the three bushmeat depots by hunters. Location-wise, Olomore had the highest return (1,457) and the least was returned to Kila (987) both in Ogun State. Species-wise, *Thryonomys swinderianus* (Grasscutter) had the highest population of 2,383 animals with a mean value of  $794.3 \pm 180.58$ , followed by *Cephalophus maxwelli* (duiker) with a mean value of  $184.0 \pm 32.51$ . The least hunters' returns were *Bitis gabonica* (Black cobra) and *Perodicticus potto* (Bosmans

potto) with their mean values of  $0.33 \pm 0.58$  and  $0.67 \pm 1.15$  respectively. The bushmeat centre with the highest number of Grasscutter of 1001 out of 2383 and Maxwell duiker with 217 out of 552 hunters' return was Olomoore while the remaining two locations shared the rest. The least animal species returned was the Black cobra (1) in the Olomoore centre (Table 4).

**Table 4.** Number of animal species returned in the three centres during the study period  
(Data source: Field Survey Calculation)

Common Name	Scientific Name	Olomore	Kila	Odo Ona	Total	Mean $\pm$ SE
Black cobra	<i>Naja melanoleuca</i>	1	0	0	1	$0.33 \pm 0.33$
Bosman potto	<i>Perodicticus potto</i>	2	0	0	2	$0.67 \pm 0.67$
Bushbuck	<i>Tragelaphus sylvaticus</i>	6	2	7	15	$5.00 \pm 1.53$
Bush fowl	<i>Francolinus bicalcaratus</i>	5	5	4	14	$4.67 \pm 0.33$
Civet cat	<i>Viverra civetta</i>	15	4	10	29	$9.67 \pm 3.18$
Crocodile	<i>Crocodilus niloticus</i>	2	4	4	10	$3.33 \pm 0.67$
Duiker	<i>Cephalophus maxwelli</i>	217	152	183	552	$184.0 \pm 18.77$
Gabon viper	<i>Bitis gabonica</i>	1	1	3	5	$1.67 \pm 0.67$
Genet cat	<i>Genetta pardina</i>	16	11	12	39	$13.00 \pm 1.53$
Giant rat	<i>Cricetomys gambianus</i>	20	20	22	62	$20.67 \pm 0.67$
Grasscutter	<i>Thryonomys swinderianus</i>	1001	667	715	2383	$794.3 \pm 104.26$
Ground squirrel	<i>Xerus erythropus</i>	13	9	13	35	$11.67 \pm 1.33$
Guinea fowl	<i>Numida meleagris</i>	3	7	5	15	$5.00 \pm 1.15$
Hare	<i>Lepus capensis</i>	61	49	54	164	$54.67 \pm 3.48$
Monitor lizard	<i>Varanus niloticus</i>	34	15	26	75	$25.00 \pm 5.51$
Mona monkey	<i>Cercopithecus mona</i>	2	0	1	3	$1.00 \pm 0.58$
Pangolin	<i>Manis tricuspis</i>	36	25	43	104	$34.67 \pm 5.24$
Porcupine	<i>Hystrix cristata</i>	8	11	10	29	$9.67 \pm 0.88$
Python	<i>Python sebae</i>	5	2	12	19	$6.33 \pm 2.96$
Shortnose crocodile	<i>Osteolemus tetraspis</i>	6	3	6	15	$5.00 \pm 1.00$
Tree hyrax	<i>Dendrohyrax dorsalis</i>	3	0	5	8	$2.67 \pm 1.45$
<b>Total</b>		<b>1457</b>	<b>987</b>	<b>1135</b>	<b>3579</b>	<b><math>1193.00 \pm 138.74</math></b>

### Sex Structure of Hunters' Returns in the study areas

Hunters' return in the three study locations revealed that a total of 3,579 individual species were deposited out of which 1,866 were male animals with the distribution as follows 761, 521 and 584 in Olomore, Kila and Odo Ona respectively. Female animals 1,713 were deposited to the locations out of which Olomoore had 696, Odo Ona Kekere had 551 and Kila had at least 466 female animals. The t-test analysis for sex structure of return in different locations showed that the differences are significant at  $p < 0.01$  for Olomore (112.88), Kila (92.5), Odo Ona (100.9) and figures with different superscripts along the row and column are significantly different  $p < 0.01$  from male and female returned hunters' returns (Table 5).

**Table 5.** Sex Structure of Hunters' Return in the Study Areas  
(Data source: Field Survey Calculations)

Sex	Olomoore	Kila	Odo Ona	Total
Male	761 <sup>a</sup>	521 <sup>c</sup>	584 <sup>e</sup>	1866 (52.1)
Female	696 <sup>b</sup>	466 <sup>d</sup>	551 <sup>f</sup>	1713 (47.9)
t-value	112.88	92.59	100.9	
<b>Total</b>	<b>1457</b>	<b>987</b>	<b>1135</b>	<b>3579</b>

Note:  $p < 0.01$  sexes

### Age Distribution of Hunters' Returns in the Study Locations

Age distribution of game returned by hunters in the different locations indicated that adults were supplied most in all the locations followed by subadults and the least are juveniles. Though

Olomooore had the highest sub-adult returned (254) the highest percentage of sub-adults returned is in Kila (19.0%). Analysis of the variance of the age structure of bushmeat returned in different locations showed that the differences are significant ( $p < 0.05$ ). This was confirmed by Levene's test for homogeneity of variance  $p$  (probability) as 0.04. But Turkey's pairwise comparison of age structure among locations showed that there were no significant differences ( $p > 0.05$ ) in their structure (Table 6).

**Table 6.** Age class distribution of game returned by hunters in the Study Location for one year  
(Data source: Field Survey Calculations)

Age	Olomooore	Mean $\pm$ SE	Kila	Mean $\pm$ SE	Odo Ona	Mean $\pm$ SE	Total
Adult	1139	22.78 $\pm$ 1.38	768	15.36 $\pm$ 0.83	903	18.06 $\pm$ 0.93	2809
Sub-adult	253	5.06 $\pm$ 0.43	188	3.76 $\pm$ 0.27	192	3.84 $\pm$ 0.27	634
Juvenile	65	1.30 $\pm$ 0.22	31	0.62 $\pm$ 0.10	40	0.8 $\pm$ 0.14	136
<b>Total</b>	<b>1457</b>	<b>29.14 <math>\pm</math> 1.77</b>	<b>987</b>	<b>19.74 <math>\pm</math> 0.87</b>	<b>1135</b>	<b>22.70 <math>\pm</math> 1.08</b>	<b>3579</b>

The taxonomic details and IUCN status of wildlife species returned to the three locations are presented in Table 7.

**Table 7.** Taxonomic details and IUCN status of wildlife species returned to the three locations  
(Data source: Field Survey Calculations)

S/N	Common Name	Scientific name	Order	Family	Total
1	Black cobra*	<i>Naja melanoleuca</i>	Elapidae	Reptile	1
2	Bosmans potto**	<i>Perodicticus potto</i>	Lorisidae	Mammal	2
3	Bushbuck	<i>Tragelaphus sylvaticus</i>	Trangelaphidae	Mammal	15
4	Bush fowl	<i>Francolinus bicalcaratus</i>	Phasianidae	Birds	14
5	Crocodile*	<i>Crocodilus niloticus</i>	Crocodylus	Reptile	29
6	Civet cat*	<i>Viverra civetta</i>	Viverridae	Mammal	10
7	Duiker	<i>Cephalophus maxwelli</i>	Cephalophinae	Mammal	552
8	Gabon viper*	<i>Bitis gabonica</i>	Viperidae	Reptile	5
9	Genet cat*	<i>Genetta pardina</i>	Viverridae	Mammal	39
10	Giant rat	<i>Cricetomys gambianus</i>	Cricetidae	Mammal	62
11	Grasscutter	<i>Thryonomys swinderianus</i>	Thryonomidae	Mammal	2383
12	Ground squirrel	<i>Xerus erythropus</i>	Sciuridae	Mammal	35
13	Guinea fowl	<i>Numidia meleagris</i>	Phasianidae	Birds	15
14	Hare	<i>Lepus capensis</i>	Leporidae	Mammal	164
15	Monitor lizard*	<i>Varanus niloticus</i>	Varanidae	Reptile	76
16	Mona monkey*	<i>Cercopithecus mona</i>	Cercopithecidae	Mammal	3
17	Pangolin**	<i>Manis tricuspis</i>	Manidae	Mammal	104
18	Porcupine*	<i>Hystrix cristata</i>	Hystriidae	Mammal	29
19	Python**	<i>Python sebae</i>	Boidae	Reptile	18
20	Shortnose crocodile*	<i>Osteolemus tetraspis</i>	Crocodylidae	Reptile	6
21	Tree hyrax*	<i>Dendrohyrax dorsalis</i>	Procaviidae	Mammal	5

Note: \*\*critically endangered, \* endangered

## DISCUSSION

One year's study of hunter's efforts at harvesting and submission of wild game at the bushmeat depots in Ogun and Oyo States revealed that more games are usually harvested during the wet season cumulatively. This was confirmed in the works of (Bowen-Jones & Pendry, 1999; Hofmann, Ellenberg, & Roth, 1999; Lindsey, et al., 2013; Calvert, Alisaukas, & White, 2017; Amusa, Azeez, & Olabode, 2021), contrary to the thinking that the harvest of bushmeat is better and easier in the dry season, attract more hunters who are less busy with farm work during the dry

season to engage in a hunting expedition, but it shows that more animals were harvested during the wet season. To buttress the earlier assertion, the total return in the three locations in November, which is the peak of the dry season portrays the highest record. But looking at the three locations differently, the months of May, November and June had the highest in Olomore, Kila and Odo Ona respectively, meaning that two of the three locations had their highest monthly return during the wet season.

The least populations of animals were returned to Kila at the end of both seasons. This may be as a result of the location being on the road between Ogun and Oyo State or probably because the hunters that are closer to these areas are mostly not full-time practitioners (Barrett & Arcese, 1998) but are mainly farmers who see hunting as a pastime or perhaps (Oso & Babalola, 2021), the other two locations in Olomore and Odo Ona have established bushmeat markets where hunters all around the two States have identified as major landing depots for their wares.

A trend of supplies was noticed in the populations of Hunters' return both seasonally and on monthly basis in each location. In the months that fell within the dry season, the three locations experienced the least supplies of the game in January and the highest in November, while in the months that fall within the wet season, the least supplies are in July and the highest was in May, September and June in Olomore, Kila and Odo Ona respectively. What this explained was the effects of seasonality and homogeneity of hunting sociology in the area (De Merode, Homewood, & Cowlshaw, 2004; Calvert, Alisauskas, & White, 2017; Akinsorotan, Olaniyi, Oguntuase, & Raheem, 2020). It goes to show that the hunters in this area had the same knowledge of when to hunt. It also depicts that weather conditions and the vegetation structure per location are important pointers to the determinations of catch per unit effort of the hunter. The little variation in ecological parameters per location may be the determinant of the changes in times of bountiful harvest and return per location in the wet season. This in agreement with various observations (Fimbel, Curran, & Usongo, 2000) (Adebowale, Oduntan, Adegbenjo, & Akinbode, 2021) can be explained to be a result of the differences in vegetation and other ecological parameters of different locations which goes to determine the quantity and types of wildlife that inhabit each location. For instance, the majority of hunting sites in Ogun State are in the derived savanna and an ecotone of the Southern Guinea Savanna while that of Oyo State are either in the secondary rain forest or derived savanna while Kila falls within the transition zones of the two.

The roles of weather and climate as a determinant of the volume of the harvest were also shown by the least returned game population per location in the dry season, where the month of January recorded the least game population returned in the three centers. This is probably because January usually has the highest number of days with a full moon in the night as postulated by (Fa, Currie, & Meeuwig, 2003; Bogerson, 2016) which thus makes hunting laborious and less rewarding. Moreover, most games returned to the depots are harvested overnight, thereby the reason for the low population of hunters' returns in January.

Sexual structures of Hunters' return to the study locations indicated that males are numerically as well as significantly ( $p < 0.01$ ) higher than females, though the populations and the sex ratios are directly proportional to the total populations of the game return to each center. The percentage ratio of males to females is almost equal in all locations. This is probably a reflection of the natural sex ratio of wildlife in the area and by extension in the wild. The reverse would have been healthier to guarantee population growth as suggested by Ntiamo Baidu (1998) and (Maisels, Keming, Kemei, & Toh, 2001) in the case of Montane forest, but hunting without restriction especially in a free area like the study locations will always present a situation as in this study. Strictly speaking, this structure may not be too bad since the persecuted sex (Males) are more than the females that are needed for population growth. In terms of age structures, it was also shown in this study that juveniles and sub-adults are rarely persecuted. An indication that the population are spared to renew itself within a very short time. This was what other researchers also suggested as a focus for discussion and training for the hunters (Onadeko & Amubode, 1998; Kates & Parris, 2003; Layade, Layade, Owoeye, Adenika, & Oyediji, 2021).



## CONCLUSION

In both season and year-round, Grasscutter was the most persecuted game, followed by Maxwell duiker, Hare and Pangolin in the three locations sampled. Out of the 21 species of games returned to the depots during the 12 months of study, these four species jointly constitute not less than 80% of supplies to each location during the period. What this shows is that these groups of animals are the main species that are commonly available and are facing hunters' persecution in their ranges in the two States. The remaining 17 species which constitute about 20% are rarely persecuted since they are not easily encountered within their ranges. The availability of this group goes to confirm the status of quite a lot of them as stated by the International Union for Conservation of Nature and Natural Resources (IUCN). One that needs attention and deserves the attention of regulators and wildlife managers is the attitude and persecution level of Pangolins whose status both locally and internationally calls for total preservation but are highly persecuted in the three sampled locations. In the endangered species act as well as the Red lists of IUCN, Pangolin belongs to Schedule I of the list and is also described by IUCN as a critically endangered species whose population are currently threatened with extinction. But these species are being traded freely and openly in the three bushmeat depots sampled, this calls to question the activities and actions of the agencies saddled with the responsibilities of enforcing those laws and conventions. Open displays of the returned endangered species and processing of same for the pots is a clear indication that if the laws exist, their enforcement is zero on any scale of performance in these States and by extension Nigeria.

In a bid to regulate the bushmeat trade and make it sustainable thereby ensuring the conservation of wildlife species in and around the area and beyond, the following activities are hereby encouraged. Bushmeat sellers and hunters need to come together as a formal body recognized, registered and licensed for proper guidance and monitoring by the State actors. This if done will give credence and emphasis to the recommendation of (Baptist & Mensah, 1986). The trade, albeit legalized but should be restricted to those animals that are not of conservation concern as suggested by (Falconer, 1992). Wildlife officers in the State need to be empowered to enforce the laws even in free areas to monitor sales and harvesting of games with safe status. Both hunters and sellers as well as all other stakeholders need to be trained on sustainable harvesting and trade in bushmeat and economic venture.

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## CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

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