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Availability pattern of key Wildlife species along five major roads of Southwest Nigeria

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Abstract

This study assembles different species of mammals and reptiles (as major sources of meat protein to man) which were displayed for sale in markets along five major highways in southwest Nigeria. Road 1 covers 264km, Road 2, stretches on 204km, Road 3 to 5 traverse the 120, 153 and 62 kilometers respectively. Wildlife markets along these roads were visited monthly for two years and mammalian with reptilian species displayed for sale in each market were recorded, this was done in 23 markets. Results revealed that Thryonomys swinderianus (grasscutters) was the most abundant mammal displayed for sale; this was followed by Cricetomys gambianus (giant rats) and Rufilatus cephalophus (Grey duiker) in descending order. The least sold along the all the road markets was Zebra (Equus guaagga). Among reptiles Veranus mambitang (Monitor lizard) was the leader while Kinixys erosa (Land Tortoise) was least sold the markets. Also, the highest frequencies of species displayed were seen along Roads 2, 4 and 5 because they fall within the catchment of forest reserves where biodiversity is high. These roads also link major commercial centres where vehicular movement is consistent. Rodents, ungulates, carnivores and primates were sold in descending order. The study recommends Government should expedite actions of environmental and natural resources conversation.

1.0 Introduction

Wildlife encompasses living things (plants and animals) especially mammals, reptiles and birds that are neither human nor domesticated (Merriam-Webster, 2024). The definition is extended to living organisms that live independent of people and in natural conditions (Collins Dictionary, 2024). On the same premises, wildlife management is the practice of influencing interactions among and between wildlife, its habitat and people to achieve predefined impacts, it is also application of science-based and local knowledge in the stewardship (including games and their habit) in a manner that is beneficial to the environment and society (Saltz and White, 2013). Wildlife conservation is the preservation aspect of animals, plants and their habitats, this way assurance is made that future generations will enjoy this natural world and the incredible species which live within it (National Wildlife Federation, 2018). Wildlife conservation in zoos and games reserves are sources of revenue, aesthetic recreation, education employment and scientific value (Adams and Salome, 2014; Ayanniyi *et. al*., 2022). In the same logical reasoning, wildlife marketing and wildlife trade refer to the sale of products that are derived from non-domesticated animals or plants usually extracted from their natural environments or raised under controlled conditions. Availability of wildlife products depends on various factors: Soewu (2008) reported higher abundance of wildlife species in markets during late dry season and early wet season. Also, Redford *et al*. (2009) documented those wild animals hunted and sold involve mammals most; this group is followed by reptiles and birds in descending order. A similar report documented that wildlife trade in southwestern Nigeria involves more animals and reptiles than other species according to Anadu *et al* (2020), the situation which has necessitated this study. This work therefore assembles wildlife sold to determine the availability pattern of mammal and reptilian species along five highway wildlife markets of southwest Nigeria and the implication for wildlife conservation.

2.0 Materials and Methods

2.1 Study area

The study area was within the attachments of five high ways in southwest Nigeria; Ibadan, Ife, Ado-Ekiti, road, named Road 1 (246km), Ibadan, Ife-Akure Road, (Road 2) with 204 km distance, Ibadan-Oyo-Ogbomosho Road or Road-3 (120km), Lagos Benin Road, (From Shagamu Interchange to Ore junction in Ondo State (Road 4 with 153km) and Road 5 was between Ibadan Toll Gate point and Sagamu Interchange in Ogun State covering 62km (Figure1)

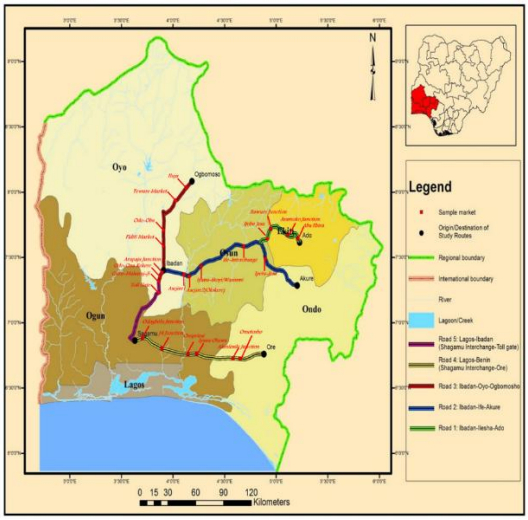

Figure 1: The Study area showing the roads and major neighboring settlements
Source: Mustafa, (2018).

Wildlife markets within 100 meters off the road on both sides of the express ways were mapped for the study; materials used were field notes, pens, pencils and copies of structured questionnaire. Twenty-three (23) markets were identified (Table 1). Wildlife products (sourced from farmers, and hunters) displayed for sale were noted, counted and grouped into mammals and reptiles according to literatures that established them (Odeowo *et al.*, 2008 and Soewu, 2008). Reptiles' numbers noted and markets Road distributions were also recorded. The same procedure was used for mammals' species abundance; their market road distribution pattern was also documented.

3.0 Results and Discussions

Reptile species availability varied markedly: the highest abundance of *Bitis arietans* (Puff adder) was highest along Road 2. The gradation was R2>R4>R5>R1>R3. Highest population of Puff adder was found in markets in the vicinity of Omo forest reserve where natural habitats are intact on a land area of 675, 123.75 hectares (UNESCO, 2020). The abundance of *Crocodilus niloticus* (Nile crocodile) was in the order R4>R5>R1>=R2>R3. Crocodiles have dual habitat nature (Diehl, 2024). The presence of gigantic Omo River with many tributaries in the forest reserve around R4 and R5 also Onigambari Forest Reserve along R4 might account for the high wildlife population, hence their hunting accordingly. *Gastrophxis samaragdina* (Emerald snake) and *Groyia smithi* (Smith water snake) were most abundant in Road 5 markets and least along Roads 2 and 3. Omo Forest reserve influence is probably operational in these areas for all wildlife sold in these markets, Road 5 had the most abundant displays of species of reptiles and least values were found for *Kinixys erosa* (Land Tortoise) in Roads 1, 3 and 4.

Table 1: Market Locations along the Study Roads

Market Roads	Locations	Km	Markets and the Coordinates of Latitude, Longitude and Altitude	States Covered
1	Ibadan-Ife-Ilesa-Ado-Ekiti Road	264	Ijebu Jesa,7°41¹N4°49¹E, +223m; Itawure Junction 7°44¹N, 4°57¹E,+265m; Aramoko Junction 7°43¹N, 5°3¹E,+300m; Aba Ebira (Ado-Iyin Road) 5°34¹N, 4°12¹E, +313m **Total: 4 Markets**	Oyo, Osun and Ekiti
2	Ibadan-Ife-Akure Road.	204	Asejire 1: 7°20¹N, 5°3¹E, +137m Asejire2(Olokere) 7°22¹N,4°7¹E, +145m Iyana-Ikoyi/Wasinmi 7°24¹N, 4°13¹E, +213m Ife-Interchange: 7°30¹N, 4°28¹E, +275m. Ipetu-Jesa 7°41¹E, 4°49¹E +294m **Total : 5 Markets**	Oyo,Osun and Ondo
3	Ibadan-Oyo-Ogbomosho Road	120	Fiditi Market,7°39¹N, l 4°41¹E, +302m Odo-Oba:7°27¹N; 4°45¹E, +306m Tewure Market 7°25¹N; 4°34¹E,+277m Iluju: 7°27¹E; 4°46¹E, +299m **Total: 4 Markets**	Oyo
4	(Sagamu–Ore road)	153	Odogbolu Junction 6°51¹N; 4°33¹E, +63m J4 Junction 6°44¹N; 4°19¹E, +72m Onipetesi 6° 44¹N; 4°33¹E, +98m Iyana Oluwa: 6°44¹N; 4°33¹E, +99m Akinfosile Junction: 6°52¹N; 3°59¹E,+101m Omotosho: 6°53¹N; 4°7¹E. +259m **Total: 6 Markets**	Ogun, Ondo
5	Lagos-Ibadan-Sagamu Interchange	62	Toll Gate 7° 20¹N; 3° 56¹E, +233m Guru-Maharaj-Ji: 7°22¹N; 3°56¹E, +189m Odo-Ona Kekere:7°14¹N; 3°52¹E, +165m Arapaja Junction: 7°18¹N, 3°52¹E, +183m. **Total: 4 Markets**	Oyo, Ogun

Source: Mustafa, (2018)

Road markets for *Naja nigricolis* (Spitting Cobra) least availability was found in Road 3. For *Python regius* (Royal Python) highest abundance was recorded along Road 5 markets and lowest displayed for sale was seen along Road 4 and Road 5 respectively (Table2).

Table 2 Species Availability Pattern of Reptiles in Relation to Road Markets Location

Scientific Name	Common Name	Sampled roads					Total	Mean
		R 1	R 2	R 3	R 4	R 5		
Bits arietans	Puff adder	18	26	5	25	23	97	19.4
Crocodilus niloticus	Nile Crocodile	2	2	0	21	20	45	9
Gastropyxis samaragdina	Emerald snake	5	0	2	0	17	24	4.8
Groya smithi	Smith water snake	2	0	0	0	21	23	4.6
Kinixys erosa	Land Tortoise	0	12	0	0	1	13	2.6
Naja nigricolis	Spitting Cobra	5	6	0	1	3	15	3
Python regius	Royal Python	8	15	11	3	28	65	13
Veranus mambitang	Monitor lizard	8	17	5	51	65	146	29.2

Source: Mustafa, (2018)

On the overall assessment of reptile species abundance in relation to roads, Table 2 reveals that Road 5 displayed the highest population of wildlife species for sale. This road links two major commercial centers (Lagos and Ibadan) in southwest Nigeria where transporters and travelers are found in huge numbers. This view was shared by Thia, (2015) that trade and urbanization are positively related. Road 3 (Ibadan-Oyo-Ogbomosho Road) had the lowest reptile sales; the road traverses many rural communities where hunted animals are rather eaten than sold to augment the rural populace protein intake. This observation was also made by Govender *et al* (2017) that most rural people are suffering from nutritional deficiency. Also, in rural communities because people live cultural and agricultural life (Ford and Cheprasov, 2023), taboos are respected, ethnomedicine is also popular, taboos and ethnomedicine might have reduced reptiles' abundance in markets along the road. Asi *et al* (2018) to support this assertion opined that food taboos can influence nutrition pattern. In the same argument, Izah and Seiyaboh (2018) posited that wildlife utilization under ethnomedicine causes variations in species abundance (Table 3).

Table 3: Road Availability Pattern of Reptiles in Markets

Common Name	Sampled Roads				
	R1	R2	R3	R4	R5
Puff adder	18	26	5	25	23
Nile Crocodile	2	2	0	21	20
Emerald snake	5	0	2	0	17
Smith water snake	2	0	0	0	21
Land Tortoise	0	12	0	0	1
Spitting Cobra	5	6	0	1	3
Royal Python	8	15	11	3	28
Monitor lizard	8	17	5	51	65
Total	48	78	23	101	178
Mean	6.00	9.75	2.88	12.63	22.25

Source: Mustafa (2018)

Among mammals, availability varies in similar ways with reptiles; among duikers, *Cephalophus leucogaster* (White duiker) had distribution R5<R1(0)=R2(0)=R3(0)<, (T=51) *Cephalophus niger* (Black duiker) was absent along R3 and other Roads were R2(33)>R5(8)>R1(5)>R3(0)(T=50) for *C. rufilatus* (Grey duiker), the distribution was higher than the previous species; R5(566)>R4(474)>R2(452)>R3(119)>R1(100)(T=1711). This situation was observed by Elenga *et al* (2019) that grey duikers are among the most sought-after antelopes for bush meat in central Africa. Among other ungulates displayed for sale, *Equus guagga* (Zebra) was poorly was distributed: R1 (3)>R2(0) =R3(0) =R4(0) <R5(3) (T=6). *Hypotragus equines* (Roan antelope) was counted as R5>R2(26)>R3(22)>R4(19)>R5(5)(T=183) *Phagochorus africanus* (Warthog) display was R5(28)>R4(26)>R2(18)>R1(9)>R3(7)(T=88) in distribution. Abundance pattern of *Syncerus afer* (Buffalo) was R1(22)>R5(4)>R4(2)>R2(0)=R3(0)(T=28) for *Tragelaphus scriptus,* (Bush buck) its trend was R1(164)>R4(56) >R5(54) >R2 (30) >R3(19) (T=323) Ungulates abundance summary was *T. scriptus* (Bush buck) (323) > *H. equeines* (roan antelopes)> (183) >*P africanus* (Warthog) (88) >*E. guagga* (Zebra) (6). Leading market Roads belonged to Roads 5, 4, 2 and 1 which belong to rainforest ecosystem especially in forest reserves where biodiversity is high. This was supported by Reyna-Hurtado and Tanner (2005) that ungulates prefer sub perennial forest as habitats. Among carnivorous species, for *Civctictis civetta* (African avet), the number displayed in markets were R5(26)> R2 (17) > R4 (11) > R1 (6) = R3 (6) (t=66) *Felis libyca* (Wild cat); R5 > R2 > R1 (5) > R3 (03) = R4 (0), T = 32.*Genetta genatta* (Civet cat) was R5 (14) > R2 (1) > R1 (0) = R3(0) = R4(0) T=15 in distribution. *Herpestis sauguineus* (fox); R2 (59) > R1 (49) > R5 (21) > R4 (2) > R3 (0) T = 631. The leading Roads were roads and Roads 5 and 2 only. They are markets within /around forest reserves and savanna zones. National Geographic (2024) also reported that cats are adapted a variety of habitats, savana, open forests scrubland, swamp and farm land.

Rodents' populations and population were unique (Figure 4). *Anomalurus becrofti* (Flying squirrel) and *Epixerus epii* (Tree squirrel) were displayed as R1(1) > R2(0) = R3(0) = R4(0) < R5(9), T=10 and R192) <R2>R3=R4<R5(18) T=80 respectively. Their frequency was lower than other rodents because they not only serve as source of wild protein but also materials for ethnomedicine, this was also documented by Soewu (2008), also that during periods of crisis, demands for amulets and pother preparations against gunshot and other such weapons do increase *Lepus capensis* (Hare) distribution was R1(32) < R2 (37) > R3 (13) < R4 (25) < (72) T = 179. *Cricetomys gambianus* (Giant rat) was more abundant in the study area; R1(67) < R2 (56) > R3(23) < R4 > R5 (95) T = 1,861. *Hystrix cristata* (Porcupine) was distributed as R1 (79) <R2 (239) > R3 (85) < R4 235 < R5 (282) T – 920. *Thryonomys* swinderianus (Cane rat or grasscutter) was the most abundant and was distributed in the pattern of R1 (243) < R2 (661)>R3 (134) < R4 (614) < R5 737, T = 2, 380. A previous study established that grasscutter is a very prolific animal (Okanlawon *et al*., 2019), giant rat is also a prolific rodent and used for both food with ethnomedicinal purposes (Ajayi *et al*, 2008) *Xerus erythropus* (Ground squirrel) was distributed as R1 (18) < R2 (118) > R3 (1) > R40 < R5 (4). T= 142. The species is under high demand for ethnomedicine, that accounts for its scanty display for sale in the markets, this was also observed by Nnamuka *et al.* (2020) that traditional medicine has impact on conservation status of some animal species *Mannis gigantean* (pangolin) showed that R1 (128) < R2(150) > R3 (44) < R4 (148) < R5 (231) T = 801. On the overall basis Road 4 was the home of mammals while Road 3 was the desert of mammals (Road 5).

Table 4: Availability Pattern of Mammals along the Road Market

Wildlife Categories	Common Names	Roads					Total	Mean
		1	2	3	4	5		
Rodent	Flying squirrel	1	0	0	0	9	10	2
	Grant rat	67	56	23	1620	95	1861	372
	Tree squirrel	2	60	0	0	18	80	16
	Porcupine	79	239	85	235	282	920	184
	Hare	32	37	13	25	72	179	35.8
	Cane rat	234	661	134	614	737	2380	476
	Ground squirrel	18	119	1	0	4	142	28.4
Ungulate	White duiker	0	0	0	51	0	51	10.2
	Black duiker	5	33	0	4	8	50	10
	Grey duiker	100	452	119	474	566	1711	342
	Zebra	3	0	0	0	3	6	1.2
	Roan antelope	5	26	22	19	111	183	36.6
	Warthog	9	18	7	26	28	88	17.6
	Buffalo	22	0	0	2	4	28	5.6
	Bush buck	164	30	19	56	54	323	64.6
Carnivore	African civet cat	6	17	6	11	26	66	13.2
	Wild cat	5	7	0	0	20	32	6.4
	Civet cat	0	1	0	0	14	15	3
	Fox	49	559	0	2	21	631	126
Primate	Columbus monkey	3	5	0	2	3	13	2.6
	Red patas monkey	4	9	1	14	26	54	10.8
	Bowman's potto	64	2	0	0	51	117	23.4
Herbivore	Tree hyrax	215	171	27	116	164	693	139
Insectivorous	Pangolin	128	250	44	148	231	801	160
Total		1215	2752	501	3419	2547	10434	2087
Mean		51	115	21	143	106		

Source: Mustafa (2018)

Table 5: Road Availability Pattern of Mammals along the Road Markets

Wildlife Category	Binomial Nomenclature	Common Name	Roads				
			1	2	3	4	5
Rodent	*Anomalurus beecroffi*	Flying squirrel	1	0	0	0	9
	Cricetomys gambianus	Giant Rat	0	0	0	51	0
	Epixerus ebii	Tree Squirrel	5	33	0	4	8
	Hystrix cristata	Porcupine	79	239	85	235	282
	Lepus capensis	Hare	32	37	13	25	72
	Thryonomys swinderianus	Cane Rat	234	661	134	614	737
	Xerus erythropus	Ground Squirrel	18	119	1	0	4
Ungulate	*Cephalophus leucogaster*	White Duiker	0	0	0	51	0
	Cephalophus niger	Black Duiker	5	33	0	4	8
	Cephalophus rufilatus	Grey Duiker	100	452	119	474	566
	Equus guaga	Zebra	3	0	0	0	3
	Hypatragus equines	Roan Antelope	5	26	22	19	111
	Phargochoerus africanus	Warthog	9	18	7	26	28
	Syncerus afer	Buffalo	22	0	0	2	4
	Tragelaphus scriptus	Bush Buck	164	30	19	56	54
Carnivore	*Civecttitis civetta*	African Civet Cat	6	17	6	11	26
	Felis libyca	Wild Cat	5	7	0	0	20
	Genetta genetta	Civet Cat	0	1	0	0	14
	Herpestitis sanguineus	Fox	49	559	0	2	21
Primate	*Colubus guereza*	Columbus Monkey	13	5	0	2	3
	Erythrocepus patas	Red Patas Monkey	4	9	1	14	26
	Periodicticus Poto	Bowman's potto	64	2	0	0	5
Herbivore	*Dendrohydrax dorsalis*	Tree Hyrax	215	171	27	116	164
Insectivore	*Manis gigantean*	Pangolin	128	250	44	148	231
Total			**1161**	**2669**	**478**	**1854**	**2396**
Mean			**48.4**	**111.2**	**19.92**	**77.3**	**99.83**

Source: Mustafa (2018)

4. Conclusion And Recommendation

Veranus mambitang (monitor lizard) was the most abundant reptile in the study site. This might be accounted for by its dual habitat nature and its highest population was found along Road 4 which is within the vicinity of two forest reserves. The least represented reptile was *Kinixys erosa* (land tortoise) only found along Road 2 and 5. The animal is under high demand for ethnomedicine. The roads related markets display revealed that Lagos-Ibadan Road links two major commercial centers therefore explaining the most vibrant market size it has. Ibadan-Oyo Ogbomosho Road traverses' rural communities where commercial activities are low, this accounted for the low sales. The same factors made Roads 4 and 5 the homes of mammals and Road 3 as no viable for mammals also species used for ethnomedicine were in low supply.

Generally, mammals were more populous and more diverse than reptiles in display for sale in the study areas *T. swinderianus* (cane rat) was the highest and *E. guagga* (zebra) the least. Also, among mammals, the pattern of sales was Rodents> ungulates > carnivores > primates. Government at all tiers should discourage over hunting of some species and forbid the exploitation of some. Environmental education against natural resources degradation should be intensified by Government through different mass media techniques in both print and electronic means.

Declaration of conflict of interest

The authors have collectively contributed to the conceptualization, design, and execution of this journal. They have worked on drafting and critically revising the article to include significant intellectual content.

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