Mammalian and Reptilian Species Expected and Observed in Roadside Wildlife Markets of Southwest Nigeria and the Implications for Conservation.

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Abstract

Wildlife provides both consumptive and non-consumptive utilities to human beings around the world. Under wild animal utilization as food and medicine, some wildlife species have been overharvested. Coupled with environmental degradation affecting wildlife species in their habitats, the need to evaluate wildlife populations in Southwest Nigeria is therefore essential. Twenty-three wildlife markets along five highways in Southwest Nigeria were surveyed for two years to determine the pattern of mammalian and reptilian species occurrence; wild animal species assessed were freshly dead and roasted ones. The species named by literatures were tagged Expected while those found in the sales points were referred to as Observed. The names of species found were matched with literatures that established them. Indirect method of species of identification was questionnaire use among stakeholders of wildlife marketing (hunters, traders and farmers) selected through Systematic Random Sampling (Odd Method). This approach firstly identified the wildlife species being sold in the markets and their vernacular (Yoruba) names. These names were linked with literatures that confirmed their scientific names. Results revealed that twelve mammalian and three reptilian species were absent in all road markets. Implication of results is that mammals and reptiles which were absent in all market Roads are those whose populations have reduced in the wild. Recommendations for Government sensitisation on animals absent in the Sales Points about hunting pressure reduction through print and electronic media were first made. Conservation education among forest exploitation professionals, campaign against forest degradation and establishment of more forest reserves and National parks by Nigerian Government were made too.

Key words: Wildlife, markets, mammals, reptiles, utilization, conservation.

Résume

La nature provide les deux utilitaires. Consommative et non consommative aux êtres humains autour du monde. A part l'usage du rêpas et du médicament de l'animal sauvage, certains animaux sauvages ont été détruits. Associé avec la dégradation environnementale qui est en train d'affecter les espèces des animaux dans leurs habitats, le bésoin d'évaluer la population des animaux au sud-ouèst du Nigéria est donc éssentiel.

Vingt-trois marchés des animaux sur le long de cinq routes nationales au sud-ouèst du Nigéria étaient examinés en deux ans pour déterminer le comportément des espèces mammifèreiennes et reptiliennes pendant l'incident. Les espèces des animaux sauvages analysées sont fraichement mortes et celles rôties. Les espèces nommées par la littérature sont étiquetées "Expected" qui veut dire espéré parcontre celles trouvées au point de vontes sont appelées "observed" qui vent dire observée.

Les noms des espèces trouvés sont égalés aux littératures qui les établient. La méthode indirecte de l'identfiication des espèces était des questionnaires utilisés parmi les supporteurs de la commercialisation naturelle (les chasseurs, les commerçants et les cultivateurs) sélectionnée grâce au prélèvement d'échantillons systémathique au hasard (une vieille méthode). Cette approche a premièrement identifié les espèces naturelles d'être vendues au marché et les norms de leurs vernaculaires (Yoruba). Ces noms étaient reliés avec les littératures qui avaient confirmé leurs noms scientifiques. Les résultats avaient révélé que douze espèces de mammifères et trois de reptiles étaient absents dans toutes les routes des marchés.

L'implication des résultats est que les mammifères et les reptiles absents dans toutes les routes des marchés sont ceux dont les populations ont réduit en sauvagérie. Les récommendations pour la sensibilisation gouvernémental des animaux absents dans les points de ventes de la réduction du préssian de la chasse grâce à l'imprimation, l'électronique et le média qui étaient prémièrement faits.

La conservation de l'education aux exploitations forestière, professionnels, la campagne contre la dégradation forestière et plus, l'établissément des parks natianaux par le gouvernement Nigérian étaient aussi faits.

Les mots dés : les animaux sauvages, le marché, les mammifères, les reptiles, l'utilisation, la conservation.

Introduction

Wildlife trade refers to the commerce of products that are derived from non-domesticated animals or plants usually extracted from their natural environments (Maron and Fobar, 2019). The use of animals for material or immaterial purposes is as old as mankind but it is a justified option for sustainable land use in African savannas (Grootenhuis and Prins, 2000). In the same vein, prior to the introduction of cosmopolitan medicine, traditional medicine used to be the dominant medical system available to millions of people in Africa in both rural and urban communities. However the arrival of the Europeans marked a significant turning point in the history of this age-long tradition and culture (Ali, 2011). Wildlife resources extend to all wild birds, animals and aquatic animal life; they also make consumptive and non- consumptive utilization for man (Career Guide, 2019). Although in the process of handling animals for man's use, some health risks are taken: Zoonoses are infectious diseases and are transmissible from lower vertebrates/animals be they domestic or wild to man and vice versa; the more phylogenetically close a species is to man, the greater the likelihood of contacting zoonoses; such diseases include typhoid fever, worm and bacterial infections (Ayodele *et al.,* 1999). Conservation and livelihood outcomes from wildlife trade are interdependent; this situation implies that the trade should be maintained through sustainable level to support the survival of traditional knowledge and culture in addition to financing basic needs in health care and education (IUCN, 2020). The way human populations have grown is the same as the demand for wildlife through a variety of sea foods, leather goods and wildlife (Atkinson, 2019). Some examples of illegal wildlife trade include poaching of elephants for their ivory and tigers for their skins and bones; however, countless other species are similarly overexploited (WWF, 2019). Conservationists long discovered that bush meat sold in Southeast Nigeria is sourced from Cameroon and they advocate collaboration between the two countries (Talabi, 2018). In the same argument, hunting in Bioko has reduced primate population in Equatorial Guinea by 90% in some areas; beautiful forests are becoming increasingly silent as their wildlife is hunted (WCS, 2015).

Phelan (2018) listed six animal species (mammals and reptiles) which overhunting and poaching might take from us forever as elephants, rhinoceros, tigers, sea turtles, lemurs and gorillas.As part of addressing the issues of biodiversity loss, Etuk *et al.* (2013) recognized biodiversity conservation as a relatively new science which must involve many professional fields such as ecology, biology, genetics, anthropology, philosophy and economics in approaching *in-situ* and *ex-situ* conservation approaches. They recommended traditional and conventional conservation strategies such as agroforestry, school programmes, zoological and botanical gardens in saving biological species from going into extinction. As part of saving key wildlife from extinction, *ex-situ* conservation approach such as animal domestication are widely practiced in Nigeria: Conservation status of wildlife species refers to the population in the wild of animals particularly in conserved or protected areas such as Games Reserves, National Parks and Strict Nature Reserves (SNRs) (Ayodele *et al*., 2013). It gives the present state and abundance and adequacy for reproduction, and the singular reason for inventories is to obtain information on the current estimates of the level of conservation of the wild animals due to problems caused by changes in their habitats (Ajibade *et al.,*2008).

A summary of domestication attempts and achievements in Nigeria on key wildlife species is shown in Table 1

Table 1: Summary of Domestication Attempts in Nigeria

S/No.	Wild Animal Species	Institutions Involved	Achievements/ Technologies Developed	Public Attitude
1	Grasscutter(*Thryonomys swinderianus)*	FRIN, FUTA, UI, FUNAAB	Bred in captivity, number of generations produced, Technologies packaged	Training workshop for farmers, Grasscutter Farmers Association formed
2.	Guinea fowl (*Numida meleagris*)	UI, KLNP.	Successfully domesticated, technologies for domestication packaged	Technologies packaged and transferred to NARI
3.	Giant rat (*Crycetomys emini*)	U.I.	Domestication ongoing.	Accepted by the public
4.	African Giant Snail (*Achachatina marginata*)	FRIN, FUTA Umudike,UNAAB, FUTO	Egg laying and hatching in captivity. Rearing technologies developed	Continuous public enquiries
5.	Crocodile (*Crocodilus amphibius*)	FRIN, FCWM N/B,	Successfullydomesticated, technology for domestication packaged.	
6.	Bush fowl (*Francolinus bicalcaratus*)	U.I.	Domestication not fully concluded	Bush meat sold at roadsides
7.	Senegal kob (*Kobus kob)*	KLNP	Domestication trials still in progress	Bush meat sold along highways

Key 1: FRIN Forestry Research Institute of Nigeria, Ibadan. 2: FUTA (Federal University of Technology, Akure), 3: FUNAAB: (Federal University of Agriculture, Abeokuta). 4:U.I. (University of Ibadan).5. KLNP. (Kainji Lake National Park) 6: FUTO (Federal University, Owerri). 7: FCWM, N/B(Federal College of Wildlife Management, New Bussa, Niger State, Nigeria). Adapted from, Imran *et al.* (2013).

Trade in non-mammalian wild animals for traditional medicine in Ogun State Nigeria stems from demand for rare, sometimes highly endangered and legally protected species, more likely to have been obtained in an environmental damaging way and which need to be smuggled or traded under clandestine conditions (Soewu *et al.,* 2012).One mammalian species that has attracted considerable attention in recent times not for its unique morphological features but its high rank in international trade is pangolin (Soewu *et al.,* 2016). The authors explained that the scales covering its dorsum and tail give it a wrong appearance of a reptile and this situation attracted its overexploitation.

Scholars have documented a checklist of wild animals in Southwest Nigeria at different times in the past: Ola-Adams (1999) listed 129 wildlife species in Omo Forest Reserve of Southwest Nigeria, Soewu (2008) reported 56 species in Ogun State of Southwest Nigeria out of which all the mammals and reptiles reported in this work were mentioned. This study therefore determined species trend in the study area. The work also compared the expected wildlife from past research with the ones observed in the study markets in order to assess their pattern of population dynamics under deforestation, pollution and wildlife overexploitation among mammals and reptiles in the roadside wildlife markets visited.

Materials and Methods

This study was carried out in wildlife sales points along five highways in Southwest Nigeria (Figure 1). The choice of these markets was borne out of the fact that they are located in forest reserves where the wildlife displayed for sale are hunted. Also, the study sites occupy five out of six States in Southwest Nigeria, implying that species reported in this work could form an updated checklist of wild animals in the area. Previous studies listed wildlife species in the same markets where this study work was done. They were

therefore expected to be seen in this study. The ones observed in the markets were compared with species expected. The Roads surveyed were Ibadan-Ife -Ado Ekiti (Road 1, 264 km long), Ibadan-Ife-Akure (Road 2, 204 km); Ibadan-Oyo-Ogbomosho (Road 3, 120 km); Lagos-Benin expressway from Shagamu Interchange to Ore (Road 4, 153 km) and Lagos-Ibadan from Ibadan end of Old Toll gate to Shagamu Interchange (Road 5,62 km long). Wildlife markets within 100 km from both sides of the main roads were located and purposively chosen for the study (Table 1). Two hundred and fifty (250) copies of structured questionnaire were administered among respondents. The selection of respondents was done through systematic random sampling (odd) method to detect wildlife species displayed for sale from times immemorial. The respondents were hunters, traders, farmers, and food vendors with minimum of twenty-five years' experience in the business. This was also done to first identify the species in vernacular (Yoruba) names. Wildlife species sold within the two years of survey were compared with the previous literatures that established them (Ola-Adams, 1999, Odewo *et al.,* 2008 and Soewu, 2008) Expected and observed species' figures were analysed using Chi Square method. The species were further grouped based on their habits as rodents (R), carnivores (C), primates (P), ungulates (U), chirops (Ch), perisodacts (Pe), artiodactyls (Ar), proboscids (Pr), herbivores (H) and pholidates (Ph).
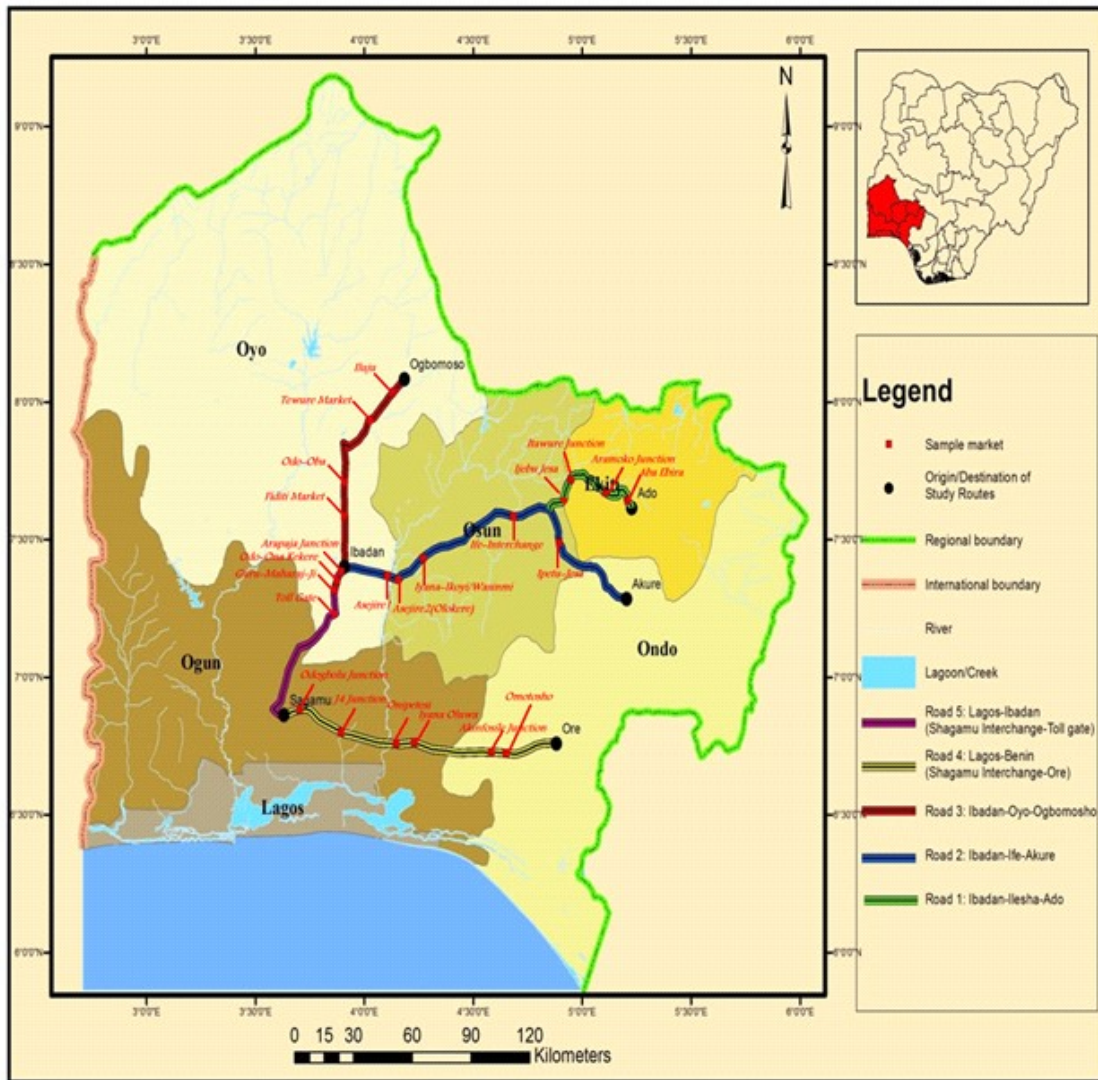
Figure 1: The Study area showing Sales Points all in Forest Reserves

Results

Assessment of mammalian species revealed 37 mammals and 11 reptile species. According to International Union for Conservation of Nature (IUCN), twelve out of thirty-seven mammals are Near Threatened: (*Canis aureus, Cerpithecus mona, Cephalophus dorsalis, Cephalophus leucogaster, Crocuta crocuta, Dicerus bicoms, Eidolon helvum, Gorilla gorilla, Hippopotamus amphibious, Loxodonta africana, Lyncon pictus, Pan trongdolyte* and *Panthera leo*, 8 were Endangered (*Dicerus bicoms, Hippopotamus amphibious, Loxodonta africana, Manis gigantean, Panthera leo, Pan trongdolyte, Periodicticus_potto* and *Genetta genetta*). 12 were Threatened they were *Anomalurus beecrofti, Canis aureus, Cephalophus mona, Cephalophus dorsalis, Crocuta crocuta C. leucogaster, Eidolon helvum, Gorilla gorilla, Syncerus afer, Genetta genetta, Equus guagga* and *Erytrocebus patas*). *Cephalophus rufilatus, Civectittis civetta, Cricetomys gambianus, Dendrohyrax dorsalis, Erythrocebus patas, Hystrix cristata, Hypotragus equines, Lepus capensis, Manis gigantean, Thryonomys swinderianus, Tragelaphus scriptus* and *Phargochoerus africanus* were found on all Roads (Table 2). Reptiles distribution assessment showed that *Epicratis cenchris, Tryionyx tronguis* and *Veranus mambitang* were Endangered. *Groyia smithii, Gastripyxis samaragdina, Naja nigricolis, Bitis arietans* and *Crocodilus amphibious* were of Least Concern. *Crocodilus amphibious* and *Naja nigricolis* were found

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Table 1: Locations and Coordinates of Sales Points

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,7⁰41¹N4º49¹E, +223m; Itawure Junction 7º44¹N, 4º57¹E,+265m; Aramoko Junction 7º43¹N, 5º3¹E,+300m; Aba Ebira (Ado-Iyin Road) 5º34¹N, 4º12¹E, +313m **Total: 4 Markets**	Oyo, Osun and Ekiti
2	Ibadan-Ife-Akure Road.	204	Asejire 1: 7º20¹N, 5º3¹E, +137m Asejire2(Olokere) 7º22¹N,4º7¹E, +145m Iyana-Ikoyi/Wasinmi 7º24¹N, 4º13¹E, +213m Ife-Interchange: 7º30¹N, 4º28¹E, +275m. Ipetu-Jesa 7º41¹E, 4º49¹N +294m **Total : 5 Markets**	Oyo,Osun and Ondo
3	Ibadan-Oyo-Ogbomosho Road	120	Fiditi Market,7º39¹N, l 4º41¹E, +302m Odo-Oba:7º27¹N; 4º45¹E, +306m Tewure Market 7º25¹N; 4º34¹E,+277m Iluju: 7º27¹E; 4º46¹E, +299m **Total: 4 Markets**	Oyo
4	(Sagamu– Ore road)	153	Odogbolu Junction 6º51¹N; 4º33¹E, +63m J4 Junction 6º44¹N; 4º19¹E, +72m Onipetesi 6º 44¹N; 4º33¹E, +98m Iyana Oluwa: 6º44¹N; 4º33¹E, +99m Akinfosile Junction: 6º52¹N; 3º59¹E,+101m Omotosho: 6º53¹N; 4º7¹E. +259m **Total: 6 Markets**	Ogun, Ondo

on four Roads. *Bitis arietans*, *Python regius* and *Veranus mambitang* were found on all Roads. Distribution of mammals showed no significant difference at 5% level of probability but reptiles had a significant difference (Table 3).

Table 2: Pattern of Mammals Availability on Selected Roads

	Species	Observed (Roads)	Expected (Roads)	Habit	IUCN Status
1	*Anomalurus beecrofti*	2	5	Rodent	NT
2	*Canis aureus*	0	5	Carnivore	NT
3	*Cercepithecus mona*	0	5	Primate	NT
4	*Cephalophus dorsalis*	0	5	Ungulate	NT
5	*Cephalophus leucogastrer*	1	5	Ungulate	NT
6	*Cephalophus niger*	3	5	Ungulate	LC
7	*Cephalophus rufilatus*	5	5	Ungulate	LC
8	*Civectittis civetta*	5	5	Carnivore	LC
9	*Colobus guereza*	4	5	Primate	LC
10	*Cricetomys gambianus*	5	5	Rodent	LC
11	*Crocuta crocuta*	0	5	Carnivore	NT
12	*Dendrohyax dorsalis*	5	5	Carnivore	LC
13	*Dicerus bicoms*	0	5	Perisodactyla	EN
14	*Eidolon helvum*	0	5	Chiroptera	NT
15	*Epixerus ebii*	3	5	Rodent	LC
16	*Erythrocebus patas*	5	5	Primate	NT
17	*Gorilla gorilla*	0	5	Primate	NT
18	*Equus Guagga*	1	5	Ungulate	NT
19	*Felis libyca*	3	5	Carnivore	LC
20	*Herpestis sanguineus*	4	5	Carnivore	LC
21	*Hippopotamus amphibius*	0	5	Arithdactyla	EN
22	*Hytrix Cristata*	5	5	Rodent	LC
23	*Hippotragus equines*	5	5	Ungulate	LC
24	*Lepus capensis*	5	5	Rodent	LC
25	*Loxodonta africana*	5	5	Proboscidae	EN
26	*Manis gigantean*	5	5	Pholidae	EN
27	*Pan trongdolyte*	0	5	Primate	EN
28	*Panthera leo*	0	5	Carnivore	EN
29	*Papio anubis*	1	5	Primate	NE
				Primate	EN
30	*Periodicticus potto*	3	5		
31	*Syncerus afer*	3	5	Ungulate	NT
32	*Thryonomys swinderianus*	5	5	Rodent	LC
33	*Tragelaphus scriptus*	4	5	Ungulate	LC
34	*Xerus erythropus*	4	5	Rodent	LC
35	*Phargocrerus africanus*	5	5	Ungulate	LC
36	*Genetta genetta*	2	5	Carnovore	NT

Source: Field Survey (2012 and 2013 Two Wet and Two Dry Seasons)

Key: EN= Endangered, LC= Least Concern, NE= Near Threatened; CR= Critically Endangered

Table 3: Presence of Reptiles along the Selected Roads

	Species	Observed N	Expected N	Habit	IUCN Status
1	*Bitis arietans*	5	5	Carnivore	LC
2	*Crocoditus amphibius*	4	5	Carnivore	LC
3	*Epicratis cenchris*	0	5	Carnivore	EN
4	*Gastropyxis samaragdina*	3	5	Carnivore	LC
5	*Groyia smithii*	3	5	Carnivore	LC
6	*Kinixys erosa*	2	5	Herbivore	CR
7	*Naja nigricolis*	5	5	Carnivore	LC
8	*Python regius*	5	5	Carnivore	NT
9	*Python sebae*	0	5	Carnivore	NT
10	*Trionyx tronguis*	5	5	Carnivore	EN
11	*Veranus mambitang*	5	5	Carnivore	EN
Total		37	55		

X^2 (0.05) = 0.0087: Significant

Source: Field Survey (2012 and 2013 Two Wet and Two Dry Seasons)

Key: EN= Endangered, LC= Least Concern, NT= Near Threatened; CR= Critically
Endangered

Mammalian Carnivorous species assessment indicated that nine species were expected but four were found. Among primates, seven were expected but three species were found. Eight ungulate species were expected, seven were observed. Rodent species distribution was intact: seven were expected and all the seven were found. Chiroptera, proboscidea, perisodactyla, pholydates and arythdactyla were expected but none among them was found in the markets surveyed (Figure 2). Ten carnivorous reptiles were expected to be found in the markets but seven were observed. One herbivorous reptile was expected; it was found displayed for sale (Figure 3)
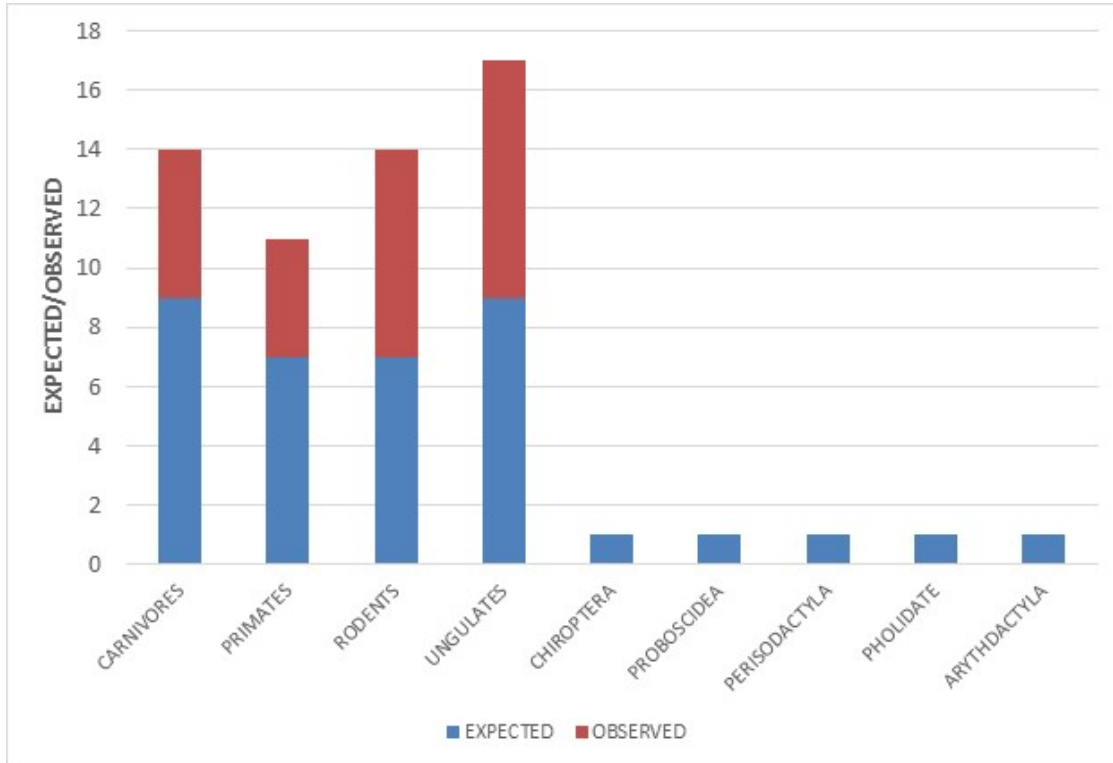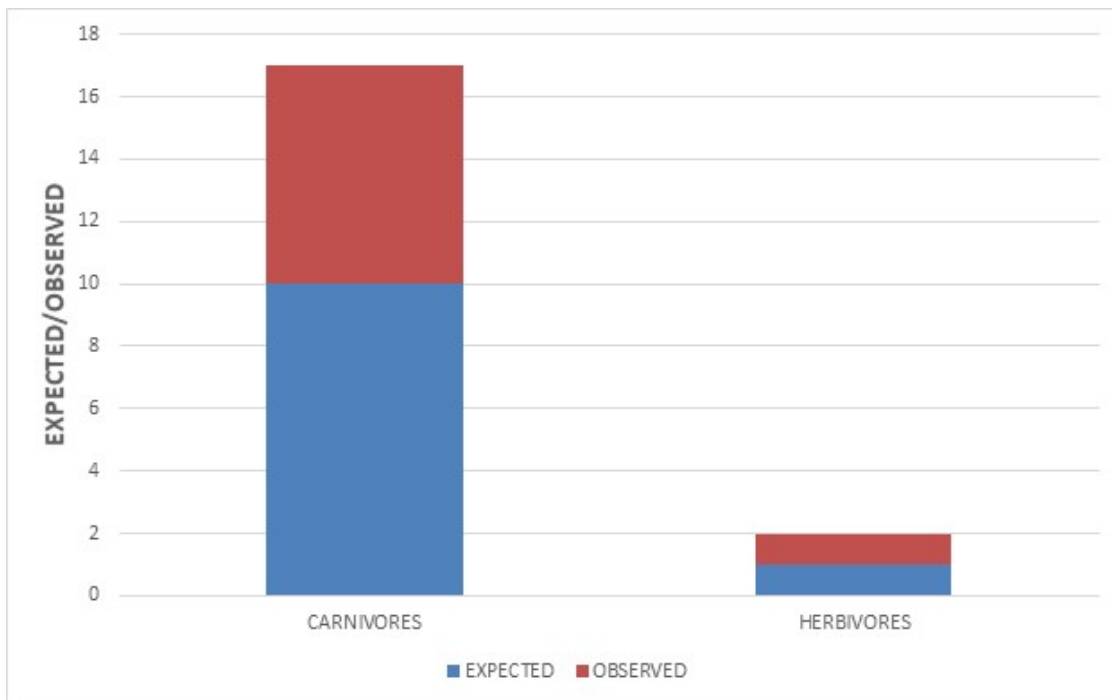
Figure 2: Number of Expected/Found Mammal Groups

Figure 3: Expected/Found Carnivorous and Herbivorous Reptiles

Discussion

Indirect approach of species identification provided useful guide in the taxonomy and identification of wildlife observed in the markets. Among mammalian species assessed in the study markets. Thirteen species that were absent along all the market roads, eight were endangered while twelve were Near Threatened. The situation is a pointer that wildlife populations in natural habitats are reducing in abundance. Conservation education and practices deserve to be practiced on these species. All mammals except rodents are experiencing population decline in the wild, especially in the natural habitats where the wildlife species are being sourced into the markets surveyed. Reptiles in the same way are suffering from population decline in the wild under this study work; this might probably be because mammals and reptiles are highly involved in traditional medicine in South-western parts of Nigeria (Soewu *et al.*, (2016). This research also shared the same view with Orji (2019) that pangolin is over-harvested under food requirements and medicine. Greengrass (2009) observed that chimpanzees (*Pan trongdolyte*) are close to extinction in Southwest Nigeria. The findings from this assessment also agreed with Izah and Seiyabor (2018) and that wildlife species experience serious population decline from over-exploitation and zootherapy. Primates suffer from population decline due to habitat degradation, predation and overexploitation (Izah and Seiyabor, 2018). Anadu *et al.* (1988) also reported a similar observation long time ago by documenting that 27 mammals and 5 reptile species are mostly hunted for food in Bendel State of Nigeria and that the most sold were Grasscutter, Giant rat, monkeys and Maxwell duiker. Rodents from this work are stable in the markets due to high reproductive abilities because of their wide spectrum of food requirements and ability to colonise as many habitats as possible (Winberg, 1978).

Conclusion and Recommendations

Mammalian and reptilian wildlife species are suffering from the problem of population decline as indicated by their species occurrence in major wildlife markets of Southwest Nigeria in this study. The wild animals greatly affected by overexploitation in this work are snakes, primates and mammalian carnivores which are hunted for food and native medicine. Rodent species from this work were almost resistant to hunting pressure probably because some of them are under domestication and human attention is gradually shifting from wild to domestic ones. Government at all levels should encourage awareness campaigns against overhunting of key species, especially those ones that their populations have declined from this study. Awareness campaigns should be through print and electronic media; enhance conservation knowledge and stress the need to respect age-old taboos in hunting among hunters. Government should also expose rural dwellers to the implications of indiscriminate bush burning and deforestation. More forest reserves and National parks should also be established by Nigerian leaders. Encouragement and funding of animal domestication by the ruling class will save key wildlife species from extinction.

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