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EDITED BY

Jamie K. Reaser,
Smithsonian Conservation Biology Institute
(SI), United States

REVIEWED BY

Jason Kirkey,
Smithsonian Conservation Biology Institute
(SI), United States
Dauda Ayomide Onawola,
Independent Researcher, Kaduna, Nigeria

*CORRESPONDENCE

Bright O. Olunusi

✉ brightolunusi@gmail.com

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Wildlife trade dynamics: exploring bushmeat market with a view toward social and ecological justice in Ibadan Metropolis Nigeria

Bright O. Olunusi^{1,2*}

¹Department of Earth and Environment, Boston University, Boston, MA, United States, ²Department of Wildlife and Ecotourism Management, University of Ibadan, Ibadan, Nigeria

This study examines the bushmeat trade in Ibadan Metropolis, Nigeria, through the lens of environmental justice, focusing on sustainable livelihoods and wildlife conservation. Environmental justice in this context seeks to ensure fair economic opportunities for bushmeat marketers, predominantly women (93%), while protecting vulnerable wildlife species. The surveyed marketers—90% of whom were married—face social inequalities, with only 50% having secondary education and 10% lacking formal education. Most marketers sell bushmeat to household consumers and travelers, raising concerns about the potential spillover of wildlife products beyond Nigeria's borders, with implications for conservation and zoonotic disease risks. ANOVA results show that greater experience leads to higher profits from species like grasscutter (*Thryonomys swinderianus*; $P = 0.005$) and Nile monitor lizard (*Varanus niloticus*; $P = 0.001$). As key species such as West African crocodile (*Crocodylus suchus*), African leopard (*Panthera pardus*), and ground pangolin (*Manis temminckii*) decline in availability in traditional hunting grounds, this study emphasizes the urgent need for conservation policies that promote sustainable trade practices and provide alternative livelihoods. These strategies would advance the science of environmental justice by reducing pressure on wildlife (ecological justice) while ensuring stable incomes for marketers (social justice).

KEYWORDS

biodiversity loss, bushmeat trade, conservation policy, environmental justice, market dynamics, sustainable livelihood

Introduction

Bushmeat is defined as the meat of wild animals stemming from the hunting of wildlife (Olunusi et al., 2022). The bushmeat trade is a complex phenomenon that intersects various aspects of socioeconomics, market dynamics, and environmental conservation. A major focus of existing studies revolves around the diversity of bushmeat species traded and the market values, with particular attention to the dominance of certain species such as the grasscutter, also known as the greater cane rat (*Thryonomys swinderianus*; Malik et al., 2019). These studies suggest that correlation between the availability and demand for specific wildlife species influences the economic dynamics of the market (Oduntan et al., 2018).

The concept of environmental justice is relatively new in the context of the wildlife trade in Nigeria, particularly regarding the bushmeat trade. While this research did not explicitly investigate environmental justice as a formalized field of work or use specific terms traditionally associated with the concept, it explores the practical indications of environmental justice within the specific context studied. Environmental justice generally refers to the equitable treatment and meaningful involvement of all people, regardless of income, gender, race, or other factors, in environmental decision-making processes that affect their lives and health (United States Environmental Protection Agency, 2024). In this study, environmental justice is understood in practice, particularly as it relates to the vulnerabilities of bushmeat traders, the sustainability of natural resources, and the socio-economic factors that shape the trade.

The bushmeat trade in Nigeria presents several layers of justice concerns, including social justice and ecological justice. Social justice refers to the gender dynamics and economic inequalities that affect traders, especially women who dominate the marketing side of the trade but are often excluded from the higher-profit roles such as hunting (Babalola, 2023). On the other hand, ecological justice is the ethical responsibility to protect ecosystems and species. It involves ensuring that wildlife species are not overexploited to the point of endangerment or extinction, thus maintaining ecosystem balance (Gaubert et al., 2023). The overharvesting of certain species, such as ground pangolins (*Manis temminckii*) and chimpanzees (*Pan troglodytes*), in the bushmeat trade is a direct violation of ecological justice, as it threatens the biodiversity and sustainability of natural habitats.

The economic viability of the bushmeat trade is another focus of research inquiry. Oduntan et al. (2017) highlighted income differentials among various classes of bushmeat, with mammals contributing significantly to total income of bushmeat trade in Oyo State. Profitability rates, as estimated by Soaga et al. (2014), demonstrate the economic viability of the trade, providing traders with substantial returns on investment. Recent study by Olunusi et al. (2023) highlights that consumer preferences for bushmeat, are driven by its nutritional value, taste, and affordability. As a result, despite efforts to reduce the trade, it continues due to ongoing consumer demand.

Although the bushmeat trade provides economic benefits, it faces some challenges such as seasonal fluctuations in supply and environmental concerns. Halidu (2019) discusses the potential negative impact of unsustainable bushmeat trade on biodiversity

conservation and recommends measures such as awareness programs and law enforcement. The depletion of wildlife in national parks due to unregulated trading activities is also of significant concern in Nigeria (Malik et al., 2019).

The specter of zoonotic diseases transforms regional bushmeat harvest and trading into an activity of global concern, due to the potential for disease spillover from wildlife to humans. For instance, a study by Olunusi et al. (2023) emphasizes the importance of implementing hygiene measures and ensuring proper cooking practices to mitigate the risk of zoonotic disease transmission from bushmeat consumption. Jagadesh et al. (2023) further explains the link between bushmeat trade and the potential for zoonotic pathogen spillover, as exemplified by the global emergence of diseases like Deltaretrovirus, Spumavirus (foamy viruses), Ebolavirus, and Henipavirus (Nipah virus). These pathogens, originating from fruit bats and nonhuman primates, pose significant health risks that could lead to endemic outbreaks in the Global South (Peros et al., 2021). Even with these well-documented risks, the bushmeat trade persists, often driven by economic necessity. Recent research has suggested that bushmeat traders may not fully recognize or prioritize these health risks, as economic pressures and the need to support their families often overshadow the potential consequences (Peros et al., 2021; Olunusi et al., 2022).

Against this backdrop of bushmeat investigation, I explored the trade of bushmeat in the Asejire and Odo Ona Kekere markets in Oyo Metropolis, Nigeria, with the goal of examining the socioeconomic, health, and environmental implications, placing a critical focus on environmental justice. While previous studies have significantly contributed to understanding bushmeat trade dynamics, there has been limited integration of these findings into policy frameworks. I bridge this gap by providing actionable recommendations that align with existing legal frameworks and policies. If implemented, these recommendations will improve biodiversity conservation and the livelihoods of these bushmeat traders in Nigeria.

Materials and methods

Study area

This study was conducted in Egbeda local Government and Oluyole local Government within the Ibadan metropolis due to the significant prevalence of bushmeat trade in these areas. Egbeda local Government, situated at longitude 3°58' and 2°0'88'E and latitude 7°22' and 46.55'N, was established in 1989 and shares borders with Osun, Lagelu, Ibadan Northeast, and Ona Ara local Governments. With eleven wards, Asejire market, a prominent bushmeat trading hub, is located within this local Government. Oluyole local Government, positioned at latitude 7°13'59.99" N and longitude 3°52'0.01" E, is one of the oldest councils in Oyo State, sharing boundaries with Ibadan South-West, Ibadan South-East, Ona-Ara, and Ido local Governments. Notably, Odo Ona Kekere, one of the major bushmeat markets in Ibadan, is situated within Oluyole local Government.

Data collection

I employed a total sampling methodology to survey all active bushmeat market traders in two key markets, Asejire and Odo Ona kekere bushmeat markets, due to their high intensity of bushmeat trade, as noted by Oduntan et al. (2017). A total of 30 traders (20 from Asejire and 10 from Odo Ona) were surveyed, representing the entire population of bushmeat traders at these markets during the study period. The structure of the bushmeat market across both sites consists of roadside sellers, allowing for easy access to traders, with most stalls situated approximately 0.2 miles apart from each other. At the Odo Ona Kekere bushmeat market, two bushmeat marketers were located behind the main market sections and slightly separated from the main cluster of stalls to avoid direct market competition.

Prior to the formal data collection, a preliminary survey was conducted to familiarize myself with the bushmeat market dynamics and observe the traders. This initial step was necessary to ensure that the final survey questions were contextually appropriate and relevant to the traders' experiences. While this early interaction could potentially introduce bias, the preliminary survey was mainly observational, focusing on understanding market interactions rather than directly questioning participants, to avoid influencing their responses during the formal data collection. To further minimize bias and capture a broad range of perspectives, the final survey included mostly open-ended questions, giving traders the freedom to express their experiences and raise issues that may not have been anticipated by the researcher (Supplementary Data Sheet 1). This approach ensured that the data collected reflected the complexity of the traders' realities and was not constrained by preliminary assumptions.

During the data collection, two research assistants supported administration of the survey at Asejire bushmeat market and one research assistant supported the project at Odo Ona Kekere bushmeat market. All surveys were conducted one-on-one, with questions asked in the local dialect (Yoruba language) as most participants did not speak English. To facilitate easy data collection, surveys were executed on weekdays when trade was not at its peak (Monday at Asejire and Wednesday at Odo Ona Kekere). We gathered data related to the demographic and occupational characteristics of bushmeat market traders, their sex, age, marital status, educational background, primary and secondary occupations, and years of experience in the bushmeat trade. Additionally, the surveys collected information on the traders' perceptions, practices, and experiences related to bushmeat marketing, such as their opinions on wildlife conservation and domestication.

I conducted descriptive statistical analyses, including frequency and percentage calculations, as well as inferential statistics such as ANOVA, with a significance level set at $\alpha=0.05$.

Results

Demographic characteristics of respondents

Table 1 provides a comprehensive overview of the demographic and occupational profile of bushmeat marketers within the study site.

TABLE 1 The table summarizes demographic and occupational information of survey respondents, including their sex, age, marital status, educational background, and primary and secondary occupations.

Variables	Label	Frequency	Percentage
Sex	Male	2	7
	Female	28	93
Age	20–30	3	10
	31–40	7	23
	41–50	11	37
	>50	9	30
Status	Single	3	10
	Married	27	90
Educational background	Primary Education	12	40
	Secondary Education	15	50
	No formal Education	3	10
Primary occupation	Marketer	30	100
Secondary occupation	None	30	100
Years of experience	<6	3	10
	6–15	3	10
	16–25	7	23
	26–35	12	40
	>35	5	17

It also details the respondents' years of experience in their primary occupation. Data is presented in terms of frequency counts and corresponding percentages for each category.

A total of 30 bushmeat marketers were surveyed. Of these, 28 (93.3%) were women, and 27 (90%) were married, highlighting their significant presence in this occupation. Most marketers fell within the age brackets of 41–50 years (11 respondents, 36.7%) and over 50 years (9 respondents, 30%), indicating a mature workforce. Educational backgrounds varied, with 15 respondents (50.0%) having secondary education, 12 respondents (40.0%) primary education, and 3 respondents (10%) reporting no formal education. This points to the diverse educational levels of the bushmeat marketers. Notably, all 30 respondents identify bushmeat marketing as their primary occupation, with no reported secondary occupations. In terms of experience, 12 respondents (40%) had between 26 and 35 years of experience, while 3 respondents (10%) had less than six years' experience, indicating a mix of both seasoned and relatively new bushmeat marketers.

Frequency distribution on sources and supply of bushmeat

Table 2 provides insights into the bushmeat trade, revealing its sources, target consumers, and the marketers' reflections on wildlife

TABLE 2 The table presents survey data on the sources of bushmeat, typical buyers, and wildlife species that have become less available over time.

Variables	Response	Frequency	Percentage
Sources of Bushmeat	Common bush	5	17
	Hunters	25	83
Buyers of bushmeat	Restaurants, Household and Travelers	19	63
	Restaurants, Household, and Taxi drivers	5	17
	Travelers only	6	20
Wild animals encountered less frequently or reduced supply by hunters over time	Roan antelope	3	10
	Chimpanzee	5	17
	West African crocodile	8	26
	African leopard	7	23
	Ground pangolin	2	7
	Grey parrot	5	17
Perception on Wildlife Domestication as a Conservation Strategy (e.g., Grasscutter)	Yes, domestication could help prevent extinction	23	77
	No, domestication is not a viable solution	7	23
Reasons for response	Past experience with similar efforts	5	17
	Current practices in rearing species like grasscutters	9	30
	Uncertainty about the feasibility without concrete reasons	5	17
	Inability to provide appropriate habitat conditions	2	6

It also includes respondents' perceptions of domestication as a strategy to prevent wildlife extinction and their reasons for these views. Data is shown with frequencies and percentages for each category.

conservation. Hunters remain the primary suppliers of bushmeat, providing most of the stock to marketers who then cater mainly to restaurants, households, and travelers. However, the bushmeat marketers have reported a noticeable decline in the availability and supply of various wildlife species over time (e.g., Roan antelope (*Hippotragus equinus*), ground pangolin (*Manis temminckii*), grey parrot (*Psittacus erithacus*)). This decline is often attributed to hunters encountering these animals less frequently in their traditional hunting grounds, indicating a reduction in their local populations. These species, while not necessarily legally protected, have become less common in usual hunting areas, likely due to decreased population densities or movement into more remote or protected areas. As these species become rarer, hunters' ability to supply them diminishes, leading to a lower supply of such bushmeat to the market.

This reduced availability led to the discussions around wildlife domestication as a potential conservation strategy. Wildlife domestication, in this context, refers to the process of breeding and managing certain wild animal species in controlled environments, such as farms or reserves. The aim is to make them more suitable for human use or conservation purposes, which could reduce the pressure on wild populations and the need to hunt them in their natural habitats, thereby helping to prevent their extinction. During interviews with bushmeat marketers, the possibility of domesticating certain wildlife species like grasscutters (a rodent heavily hunted in Nigeria) was discussed. According to WildAid Africa (2021), the grasscutter is known for its adaptability to controlled breeding, making their domestication a potential source of alternate income. However, the respondents expressed mixed views on the effectiveness of wildlife domestication as a conservation strategy. Some saw it as viable, based on their own experiences or observations of others successfully breeding grasscutter, while others questioned its feasibility.

Furthermore, the study revealed the profitability of various bushmeat types sold by marketers. Grasscutter (*Thryonomys swinderianus*), the most sold and preferred bushmeat, yielded profits ranging from ₦1,000 to ₦3,000 per unit sold, equivalent to approximately US\$1.30 to US\$3.90. Kob antelope, the second most preferred, generated profits between ₦2,000 and ₦4,000 per unit sold (around US\$2.60 to US\$5.20). In contrast, the Gambian pouch rat (*Cricetomys gambianus*) provided the lowest profits, typically ranging from ₦300 to ₦400 per unit sold (approximately US\$0.39 to US\$0.52). The highest profits were from also known as red river hog (*Potamochoerus porcus*), with earnings between ₦3,000 and ₦5,000 per unit sold, equivalent to US\$3.90 to US\$6.50. It is worth noting that these profit margins per unit are quite substantial in the Nigerian context, where a university professor earns an average of ₦500,000 (around US\$650) per month. This comparison highlights the significant financial incentive for traders in the bushmeat market.

As seen in Table 3, inferential statistics, specifically one-way ANOVA, were conducted to examine the association between marketers' years of experience and the profits made from different types of bushmeat. The results revealed significant differences in experience affecting profit levels for grasscutter (F2,

TABLE 3 The table presents the Analysis of Variance (ANOVA) results examining the relationship between marketers' years of experience and their profit from selling various bushmeat species.

		Sum of squares	df	Mean square	F	Sig.
Grasscutter profits	Between Groups	14.210	4	3.552	4.803	.005
	Within Groups	18.490	25	.740		
	Total	32.700	29			
Kob antelope profits	Between Groups	4.063	4	1.016	2.591	.061
	Within Groups	9.803	25	.392		
	Total	13.867	29			
Ground pangolin profits	Between Groups	.833	2	.417	2.647	.125
	Within Groups	1.417	9	.157		
	Total	2.250	11			
African bush-tailed porcupine profits	Between Groups	.308	2	.154	.769	.489
	Within Groups	2.000	10	.200		
	Total	2.308	12			
Nile monitor lizard profits	Between Groups	9.250	3	3.083	9.088	.001
	Within Groups	4.750	14	.339		
	Total	14.000	17			
Bush pig profits	Between Groups	.075	1	.075	.562	.482
	Within Groups	.800	6	.133		
	Total	.875	7			

The analysis covers six bushmeat types: grasscutter also known as greater cane rat (*Thryonomys swinderianus*), Nile monitor lizard (*Varanus niloticus*), kob antelope (*Kobus kob*), ground pangolin (*Manis temminckii*), African bush-tailed porcupine (*Atherurus africanus*), and bush pig also known as red river hog (*Potamochoerus porcus*). The table includes values for sum of squares, degrees of freedom, mean square, F-value, and significance level, indicating whether the variation in profits is significantly influenced by marketers' experience.

29 = 4.803, P = 0.005) and Nile monitor lizard (*Varanus niloticus*; F3, 7 = 9.088, P = 0.001). Similarly, significant differences were found for kob antelope (F2, 29 = 2.591, P = 0.061) and ground pangolin (F2, 9 = 2.647, P = 0.125). However, there were no significant differences observed for African bush-tailed porcupine (*Atherurus africanus*; F2, 10 = 0.767, P = 0.489) and bush pig (F1, 6 = 0.562, P = 0.482), indicating that experience did not significantly impact profit levels for these bushmeat types.

Moreover, the study identified key associations governing the activities of bushmeat marketers. Seventy percent of respondents reported paying a levy imposed by the association of bushmeat

marketers for their sales, while 30% indicated they were not subject to this levy. The levy is not a government tax, but an internal fee collected by the marketers' association to support the operational and administrative functions within the markets. There are no regulations set by the association regarding the quantity of bushmeat sold per day, and the scale of the levy varies depending on the amount of bushmeat traded.

Discussion

Demographic characteristics of respondents

The gender dynamics within the bushmeat trade in Oyo State, Nigeria reveals a notable predominance of women comprising 93.3% (28 respondents), highlighting their substantial involvement in the sector, consistent with previous studies by Oduntan et al. (2018) and Babatunde et al. (2020). This contrasts with earlier reports by Oduntan et al. (2017), which indicated a male majority in similar settings. This suggests a shifting gender dynamic within the trade which may be due to distinct roles assumed by men and women, as highlighted by Babalola (2023), with men primarily engaged in hunting activities and women taking on marketing roles (Ijose, 2018).

While both genders can benefit economically from the trade, disparities exist in access to roles, benefits, and risks. Men typically dominate hunting roles, exposing them to physical labor and inherent risks, but they also enjoy the highest profit margin possible within the bushmeat market structure (Olunusi et al., 2022; Babalola, 2023). Conversely, women, who primarily act as market traders, face economic challenges. They purchase bushmeat from hunters at a fixed rate and resell it for a lower profit margin, as documented by Olunusi et al. (2022) and Cowlishaw et al. (2004). This market structure restricts women to intermediary roles, offering less opportunity for substantial financial gain compared to their male counterparts. The gender-based division coupled with other gendered barriers such as limited access to financial capital, reduced market opportunities, and mobility constraints, further restrict their ability to negotiate prices and expand their businesses (Alliance for Financial Inclusion, 2016). This structural inequality worsens the income gap, reducing the potential benefits women could derive from the trade.

Furthermore, in alignment with the work of Babatunde et al. (2020) and Oduntan et al. (2017), my findings revealed that a significant proportion of individuals engaged in bushmeat marketing are middle-aged, with 43.3% (13 respondents) falling within the 31–40 age range, 30% (9 respondents) within the 41–50 age range, and 6.7% (2 respondents) above 50 years old. This proves that majority of the marketers are in their active age. Additionally, this study reveals that 10% (3 respondents) of respondents were single, while the vast majority (27 respondents, 90%) were married. This suggests that many women engaged in the bushmeat trade have familial responsibilities, which may serve as a motivating factor to continue their involvement in the trade, especially in the absence of viable alternative livelihood options. This emphasizes the social

justice aspect, as the lack of other opportunities can perpetuate economic reliance on bushmeat marketing for the traders.

The educational profile of bushmeat market traders reveals a significant proportion with only secondary education (15 respondents, 50%), followed by those with primary education (12 respondents, 40%), and 10% (3 respondents) lacking any formal education. These findings align with previous research by Babalola (2023), Malik et al. (2019), and Oduntan et al. (2017), indicating a prevalent lack of substantial formal education among market traders. This educational deficit contributes to their predominance in the informal sector, as they are often ill-equipped for formal employment opportunities. In Nigeria, where only 17% of workers have wage jobs capable of lifting them out of poverty, according to a World Bank (2022) report, even individuals with higher education struggle to secure formal employment. The dearth of formal education places bushmeat traders at a further disadvantage in accessing profitable job opportunities. Consequently, emphasis in the society tends to prioritize extractive industries (Akakuru et al., 2022) like agriculture and the bushmeat trade for sustained livelihoods. Additionally, the overwhelming reliance of bushmeat traders on this market activity evident, as indicated by their lack of alternative income sources. Notably, all respondents in our study were found to be full-time bushmeat traders with no other means of income, reinforcing social inequities in access to sustainable livelihood options.

Moreover, the results reveal that a significant majority (17 respondents, 56.7%) of traders have amassed over 25 years of experience in the bushmeat industry, indicating a sustained presence and dependence on this trade. Soaga et al. (2014) corroborated this finding by stating that most of the traders inherited the bushmeat business and started with little or no capital. Conversely, 10% (3 respondents) of traders have fewer than six years of experience, suggesting a continual influx of newcomers into the trade. This points to the level of reliance of these traders on the bushmeat marketing sector for their livelihoods. Interestingly, our findings contrast with those of Malik et al. (2019) who conducted a study in the northern Nigerian state of Benue, where most respondents (57.1%) had only 1–5 years of experience. This disparity suggests that the bushmeat trade as a livelihood avenue is not only enduring but also expanding, with new individuals entering the market across different regions of the country.

Sources and supply of bushmeat

Table 2 provides valuable insights into the sources and supply of bushmeat, shedding light on the operational aspects of the trade and its potential ecological ramifications. The results indicate that the majority of bushmeat is sourced from hunters (25 respondents, 83.3%), with a smaller proportion obtained directly from common bushes (5 respondents, 16.7%). The term “common bush” generally refers to areas of wild, undeveloped land or forests that are not privately owned or intensively managed, often found on the outskirts of rural communities (Nasi et al., 2008). In these regions, natural resources, including wildlife, may be commonly accessed or perceived as communal property by local populations. This finding

aligns with the research of Babalola (2023), emphasizing the reliance of bushmeat marketers on hunters as their primary suppliers. Furthermore, the results highlight the intermediary role of bushmeat marketers, who predominantly supply bushmeat to restaurants, travelers, and households. This demand-driven trade, as emphasized by Olunusi et al. (2023) and Malik et al. (2019), contributes to the pressure on wildlife populations. While our results highlight that travelers are one of the major buyers of bushmeat, we did not capture explicit evidence of international transport. However, the WildAid Africa (2021) report suggests that bushmeat purchased by travelers may reach international markets. Ground pangolins, for example, are frequently traded from Nigeria to countries such as China, Vietnam, and Singapore. This report also highlights how local consumption is linked with illegal global wildlife trade networks, as bushmeat and wildlife parts move across borders to meet international demand.

The structure of the bushmeat market, as earlier stated, predominantly involves hunters, marketers, and consumers, all of whom are exposed to potential risk of zoonotic diseases. Jagadesh et al. (2023) highlighted a strong correlation between bushmeat consumption and the spillover of zoonotic pathogens, with over 60% of emerging infectious diseases originating from animals. Examples include SARS, MERS, Ebola, HIV, and COVID-19, with over two-thirds originating from wild species (Max Planck Society, 2020). Despite these health risks, bushmeat marketers often underestimate the associated hazards, citing their own experiences and knowledge as justification (Peros et al., 2021). Interestingly, during interviews, some bushmeat marketers mentioned the Ebola outbreak as a reason for past declines in sales but noted that sales had recovered, and they do not believe that bushmeat posed a disease risk. This demonstrates a gap in understanding, where the fear of zoonotic diseases impacts livelihoods during outbreaks as consumers desist from patronizing the traders, but the long-term recognition of ongoing risks is underestimated. Gaubert et al. (2023) observed that bushmeat vendors in Central and West Africa primarily rely on health-related information from television channels and social networks, often subscribing to the belief that if a species has never been a disease vector, it will never become one. Unfortunately, zoonotic diseases present an ongoing vulnerability for individuals involved in the trade of wildlife, and misconceptions about disease risks could exacerbate future outbreaks.

Bushmeat profitability

On a more positive note, the bushmeat trade has been reported to be highly profitable for those involved. The profitability of various bushmeat types varies; for example, as revealed by this study, the sale of mammals yields higher profits compared to wild birds, highlighting the commercial appeal of certain bushmeat species (Oduntan et al., 2017; Soaga et al., 2014). The disparity in profit levels among different bushmeat types suggests varying market demand and pricing dynamics, which may be influenced by cultural preferences and consumer behavior (Oduntan et al., 2018). The findings also illuminate the role of experience in shaping profit levels within the bushmeat trade. While experience was found

to significantly influence profits for certain bushmeat types, such as grasscutter and Nile monitor lizard, no significant impact was observed for other bushmeat types. However, it is important to note that while bushmeat trade may seem lucrative in the short term, its long-term sustainability is questionable (Malik et al., 2019; Soaga et al., 2014).

Sustainable wildlife utilization

In addition to the socio-economic and zoonotic disease vulnerabilities mentioned previously, there is also an ecological justice aspect of the bushmeat trade to consider, where advocating for a more sustainable approach to bushmeat trade is crucial. The results in Table 2 highlights the decline in the supply and availability of certain wildlife species which could be due to unsustainable trade practices, as evidenced by the threatened status of the reported species. Wildlife species such as chimpanzee, African leopard, ground pangolin, and grey parrot are all listed as threatened according to the IUCN Red List (2023). This highlights the pressing ecological consequences of unchecked bushmeat trade, as noted by Soaga et al. (2014) and Ijose (2018), who also emphasized the strain on biodiversity conservation efforts. The loss of these species not only disrupts ecosystem functioning but also erodes the cultural and ecological significance of biodiversity-rich habitats (Gupta et al., 2023). Additionally, it means that future generations would not get to see or experience certain types of wildlife that have gone extinct.

Despite this, a significant proportion (23 respondents, 76.7%) of bushmeat traders expressed that domestication of certain wildlife species, like the grasscutter, could prevent extinction, reflecting their recognition of the potential for sustainable alternatives. Other 7 respondents (23.3%) voiced skepticism about the feasibility of domestication, with majority citing concerns about providing adequate conditions for wildlife. Until the concept of wildlife domestication to supply meat markets is supported by effective implementation strategies, including access to resources, training programs, and supportive policies, a transition from wild harvesting is not likely (Hilderink and de Winter, 2021). Additionally, addressing concerns about providing adequate conditions for wildlife requires collaboration among stakeholders, such as government agencies, conservation organizations, and local communities. By combining knowledge with practical support and collaborative efforts, there is greater potential for the successful adoption of sustainable alternatives in the bushmeat trade, leading to improved conservation outcomes (ecological justice) and livelihood opportunities.

Recommendations to policy makers

According to the Government of Nigeria et al. (2022), legal frameworks exist to ensure compliance with national and international commitments to legal trade and combating wildlife crime. These frameworks aim to raise awareness of wildlife crime, generate social and political will among stakeholders regarding the value of nature, and provide alternative livelihoods by empowering local communities through the development of wildlife crime

prevention initiatives and alternative livelihoods for the period 2022–2026. However, I propose two additional policies that emerge from my findings. These recommendations will further social and ecological justice.

1) Enlightenment and empowerment

It is the responsibility of the state and federal government, along with all wildlife stakeholders to spread the knowledge of wildlife conservation around us. For example, the Department of Wildlife at the University of Ibadan, while celebrating World Wildlife Day on March 3rd, 2024, invited hunters in Oyo State to learn about domestication, sustainable resource use, and the consequences of species extinction. The communication was delivered in Yoruba to ensure understanding among the local population. In this context, conservation experts must take up the task of public outreach. Hilderink and de Winter (2021) highlighted that there is often partial knowledge, misinformation, or even a complete lack of awareness regarding the risks associated with the bushmeat trade. Gaubert et al. (2023) also stressed the importance of closely monitoring the media to ensure accurate information is disseminated, as opposed to misinformation. By raising awareness about the effect of overexploitation of bushmeat and the zoonotic risks associated with its trade and consumption, it is possible that bushmeat market traders and other involved actors will reduce their hunting activities. However, this increased awareness must be paired with efforts to empower communities to adopt sustainable alternatives.

Empower people. Given the high dependence of bushmeat marketers on bushmeat trade, there is a need to provide alternative sources of income to these people. Otherwise, combating wildlife trade will be useless as people will look for non-transparent means to continue trading. (Hilderink and de Winter, 2021). According to Van Velden et al. (2020), survey results in Malawi showed that local communities preferred alternative sources of livelihood that would guarantee long-term empowerment opportunities over gaining access to park-based products like bushmeat. The authors stated that the alternative source of livelihood option was for households to receive three goats and be trained in livestock management. Similarly, such a test could be implemented in Nigeria to ascertain peoples' alternative livelihood preferences. Both the local and national governments need to commit to training these marketers as they have little or no formal education nor any alternate employment.

2) Tighten existing conservation policies

Enforce conservation. There is a need to tighten existing wildlife conservation policies. This involves bolstering the legal framework and regulations governing wildlife protection and conservation to deter illicit activities and safeguard vulnerable species. This may include measures such as increasing patrols in protected areas, strengthening surveillance and monitoring mechanisms, and imposing stricter penalties for wildlife-related offenses.

A community-based approach can be instrumental in enhancing policy enforcement by incentivizing residents to report instances of wrongdoing and illegal activities (Sollund, 2022). This strategy entails engaging and empowering communities residing in and around areas susceptible to wildlife trade, encouraging them to

actively participate in conservation endeavors. By offering rewards or benefits for providing information leading to the apprehension of offenders, communities are motivated to take ownership of wildlife preservation efforts. This approach has shown promise in similar contexts, as demonstrated by Heermans et al. (2021) in northern Botswana. It not only strengthens law enforcement effectiveness but also cultivates a sense of ownership and stewardship among community members toward their natural heritage.

Conclusively, this study highlights the need for social and ecological justice by promoting sustained alternative livelihoods to reduce reliance on declining wildlife, hereby addressing the key environmental justice concerns of bushmeat trade. Additionally, the bushmeat trade is not isolated; its links to international markets and the potential for zoonotic disease spillovers emphasize its global significance. Effective interventions must align local sustainability efforts with global wildlife trade policies to ensure both ecological integrity and economic stability.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical approval was not required for the studies involving humans because it lies in the institutional guidelines of the University of Ibadan, which does not mandate ethical approval for all research endeavors unless specific circumstances such as involvement of vulnerable groups, collection of blood samples, or biomedical research necessitate it. However, research methods are still subjected to scrutiny by departmental professors to ensure adherence to ethical standards. Furthermore, the study exclusively involved roadside sellers aged 18 and above who openly identified themselves and willingly participated in the research. Given the nature of the participants and the voluntary nature of their involvement, formal ethical approval was deemed unnecessary. Nonetheless, ethical considerations were upheld throughout the research process, with participants being informed of the study's purpose and the voluntary nature of their participation, and measures were taken to ensure data anonymization and confidentiality. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required from the participants or the participants' legal guardians/next of kin in accordance with the national legislation and institutional requirements because as for written informed consent, it was not required for this study due to the practical considerations of the research context. The participants, being roadside sellers, engaged in face-to-face interactions with the researchers and were briefed on the study's objectives and procedures. Their willingness to participate was ascertained verbally, and they were assured of their anonymity and confidentiality. Given the informal setting and the nature of the interactions, obtaining written consent would have been logistically challenging and potentially intrusive. However, verbal consent was obtained from each participant before their involvement in the study,

ensuring that they were adequately informed and willing to participate. This approach maintained ethical integrity while respecting the practical constraints of the research environment.

Author contributions

BO: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

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Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fcosc.2024.1401308/full#supplementary-material>

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