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Review article

# Global patterns and drivers of wildlife hunting and trade: A review

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ABSTRACT

The use of wildlife—dead or alive—for various purposes is driving a biodiversity crisis worldwide. Developing a coherent global strategy to tackle this crisis, although a high priority, has been hindered by limited data at both global and regional levels. Here, we reviewed 642 original research articles published between 1979 and 2020 to assess the global patterns of wildlife hunting and trade and their drivers, including hunting techniques. We found that, on average, 51.72 ± 23.26 % of the population in the reported locations is involved in the wildlife hunting, while an average of 41.88 ± 36.63 % of the population consumes wild meat. Mammals are the most targeted species (14 %), followed by birds (3 %) and reptiles (2 %). We identified twelve major drivers of wildlife hunting: subsistence consumption, cash income/trade, cultural/traditional/religious use, medicinal use, pets, delicacies, poverty, recreation, ornamental use, retaliation, social prestige, and poor law enforcement/social instability. Additionally, we assessed eleven major drivers of wildlife trade, three of which — physical markets, market demand, and globalization/market networks/online platforms — differed from those driving hunting. While the drivers of both hunting and trade varied significantly in terms of reported cases, they were of similar proportions among regions defined by the World Bank. There were five major techniques of wildlife hunting (dogs, modern firearms, poison/chemicals, traditional weapons, and traditional catching), which were similarly proportioned across regions. Our findings are based on empirical studies of wildlife hunting and trade, primarily conducted in rural areas; therefore, they should not be generalized as representative of global populations. Overall, our review presents a global rural snapshot of wildlife hunting, largely driven by the need to meet subsistence living and consumption requirements. In contrast, trade is fueled by the presence of local markets and the need for monetary gain. The global conservation community should consider the multidimensional aspects of hunting and trade, including societal needs, when developing an appropriate strategy for wildlife conservation.

## 1. Introduction

Wildlife hunting and trade have a long history, dating back to early human civilization [1,2]. Initially, hunting was primarily for subsistence, with collective efforts often organized to maximize success, which is believed to have contributed to humans' adaptation and survival [3]. Early subsistence hunting relied on primitive tools and technologies, shaped by availability and demand [4]. Although humans gradually transitioned to farming and domestic animals, wildlife hunting persisted [4]. With the development of markets, improved communication, and access to forests — along with modern firearms — hunting also began to serve trade purposes [5]. Today, hunting occurs in many countries worldwide, varying considerably in terms of scale and purpose, from subsistence use to commercial exploitation [6]. It has become one of the largest and most complex illegal trades globally [7], posing a significant and rapidly growing conservation challenge [8]. Besides, wildlife hunting and trade is closely linked with public health crisis such as emergence of zoogenic disease. The bovine virus, for example, is believed to have evolved into measles during the 11$^{th}$ to 12$^{th}$ centuries, with the increasing domestication of animals [9]. Between 1940 and 2004, 60 % of emerging diseases were zoonoses, 72 % of which originated from wildlife [10]. Recent, examples include Ebola, Marburg, Lassa, and Coronaviruses such as SARS-CoV-1, MERS, and SARS-CoV-2 [7,10–12]. Thus, human interactions with the environment have become increasingly critical for a safe and secure life [13,14], including public health crisis [11]. However, our understanding of the extent and variability of wildlife hunting and trade is limited by a lack of data at both local and global levels [6,15]. This gap is critical, as these activities encompass interactions among social, cultural, religious, economic,

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legal/administrative, and ecological dimensions that have yet to be fully reviewed and understood [15–18].

This review considers hunting and trade within a broader socio-ecological framework without regard to the legality of such activities, examining patterns and drivers in historical and current political, economic, and social contexts. Wildlife trade exists to serve various purposes, from localized trade for supplementary income to large-scale commercial exploitation. Early records of large-scale wildlife exploitation date back centuries as part of transcontinental trade networks [19]. For example, wildlife products such as silk, furs, and animal parts were exported from China to the Indian subcontinent and Mediterranean countries approximately two thousand years ago along the Silk Road. In return, items like ivory, rhinoceroses' horns, pearls, coral, and rare animals were imported to China [20]. Over time, advancements in hunting weapons [21] and technologies [22] have significantly increased the scale and impact of hunting. This expansion has led not only to extensive bushmeat depletion [23] but also to the endangerment and extinction of the numerous species [24], including tigers, Javan rhinos, elephants, orchids, reptiles, gastropods, and tarantulas [15, 25–27]. Additionally, hunting and trade have facilitated the spread of invasive species and the transmission of zoonotic diseases from animals to humans [26,28].

Since the mid-20th century, governments worldwide have implemented national laws to regulate or control wildlife trade and hunting. The entry into force of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) has further strengthened these efforts [29]. However, hunting and trade remain widespread in many regions, driven mainly by cultural practices, food needs, and economic incentives, with the importance of these factors varying by location [30–32]. Economic benefits are significant, but motives and scales differ, ranging from opportunistic hunting for income to large-scale commercial operations [33,34]. Hunting can also be associated with leisure activities, lifestyle choices, or social prestige [33], as well as with retaliatory killings in response to human-wildlife conflicts, such as crop damage and human injuries or fatalities [16]. While motives for consumption vary, wild-sourced meat remains a critical source of animal protein in many rural areas [35]. Consumption of wildlife meat is often tied to traditional preferences, taste, price, availability, or medicinal uses, with usage patterns ranging from occasional consumption to daily dietary reliance [36,37]. To effectively manage wildlife hunting and trade and to protect endangered species and human health, it is essential to understand the patterns and their underlying drivers. This review aims to provide a consolidated global overview of wildlife hunting and trade, focusing on (a) pattern of wildlife hunting and consumption, (b) drivers of hunting and trade, (c) means of hunting, and (d) taxonomic pattern of wildlife hunting and trade.

## 2. Materials and methods

In our review, we focused on peer-reviewed original research articles published in English on the hunting and trade of wildlife species, using the PRISMA framework for systematic reviews and meta-analyses [38]. The PRISMA framework provides a structured approach for conducting literature reviews, including searching, selecting, and categorizing articles, as well as performing content analysis.

The search was performed in both Scopus and Google Scholar. Scopus is one of the largest and multidisciplinary search systems and is well suited for primary review of conservation literature, whereas Google Scholar is suitable for identifying supplementary sources of information [39].

We searched the Scopus database for papers published until December 2020, including one of the following terms in the title, abstract and keywords: “Wildlife Consumption” “Bushmeat Harvest”, Ethnozology, Bushmeat, “Wildlife Trade”, “Wildlife Hunting”, “Illegal Wildlife Trade”. The search returned 1698 publications. We used Harzing's “publish or perish” (www.harzing.com) tool to retrieve 2000 papers from Google Scholar. The detailed method of selection of papers for our study is explained in Fig. 1 (See Appendix A for list of paper). We classified each paper into various subcategories (Table 1). We used World Bank Regions for data analysis and aggregated reporting. The World Bank classifies countries into seven geographical regions—East Asia and Pacific, Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, South Asia, Sub-Saharan Africa, and North America—for the purposes of economic analysis, development planning, and project implementation. This classification is based on geographic proximity, shared development contexts, and the need for administrative efficiency [40].

### 2.1. Data analysis

We listed reported drivers of wildlife hunting and trade and computed frequency distribution of all possible drivers. We then combined similar drivers with less than five reports. The same procedure was used to identify means/techniques of wildlife hunting. A Chi-squared goodness-of-fit was carried out to examine whether frequencies (hunting driver, trade driver and technique of hunting) were significantly different from the expected equal distribution using R package “RVAideMemoire” [41]. We performed a proportion test (test statistic Z) comparing frequency counts of hunting and trade drivers and techniques of hunting by regions. All analyses were carried out in R [42] using various packages: ‘pastecs’ for descriptive statistics; ‘waffle’ and ‘ggplot2’ [43] for data visualization; ‘chisq.test ‘, and ‘prop. Test’ of R base, to carry out Chi-squared and proportion test respectively.

## 3. Results

We reviewed 642 peer-reviewed research articles, which included 490 papers (85 %) on hunting and 383 papers (55 %) on trade and 229 papers (40 %) on both hunting and trade. The 642 papers included in our study represented 88 countries from six continents (Fig. 2).

### 3.1. Frequency of wildlife hunting, consumption and trade

The proportion of population involved in wildlife hunting ranged between 7 % and 99 %, with a global average of 51.72 ± 23.26 % (mean ± SD). Regionally, the highest hunting participation was observed in East Asia & Pacific (58.50 % ± 9.19), followed closely by Latin America & Caribbean (55.76 % ± 21.16) and Sub-Saharan Africa (52.87 % ± 27.24), while South Asia reported the lowest (22.00 % ± 1.17). A similar trend was observed for wild-sourced meat consumption with a global average of 41.88 ± 36.63 % and similar regional variation. Reported wild meat consumption amounted 4.70 kg per person per month, 10.71 kg per household per month and 25.23 kg per square kilometer per month. People's involvement in wildlife trade was relatively high overall (58.12% ± 31.08). The proportion varied by region, with Sub-Saharan Africa reporting the highest (84 ± 7.77 %), followed by East Asia & Pacific (65.75 ± 25.81 %). The proportion of hunted animals subjected to trade averaged 65.75 ± 25.80%. The Sub-Saharan Africa reported the highest proportion (84.5 ± 7.78%), followed by Latin America and the Caribbean (37 %), and East Asia and the Pacific (26.5 %) (Fig. 3, Table 2). There were no records reported from Europe and Central Asia.

### 3.2. Drivers of wildlife hunting and trade

We identified twelve primary drivers of wildlife hunting, with significant differences in their frequency ($X^2$ = 950.74, df = 12, $P < 0.001$). The most frequently reported driver was subsistence consumption (31 %), followed by cash income/trade (28 %), cultural/traditional/religious use (8 %), and medicinal use (8 %). Other drivers, such as the pet trade (5 %), delicacy (4 %), poverty (4 %), recreation (4 %), ornamental use (3 %), retaliation (3 %), and social prestige (3 %), each represented smaller proportions. Poor law enforcement and social instability accounted for 2 % of cases (see Fig. 4).

In analyzing wildlife trade, we identified eleven primary drivers, with eight overlapping with those of hunting. These drivers also varied significantly in frequency ($X^2$ = 150.63, df = 10, $P < 0.001$). Market demand drove nearly one-fifth (19 %) of reported trade cases, followed by the

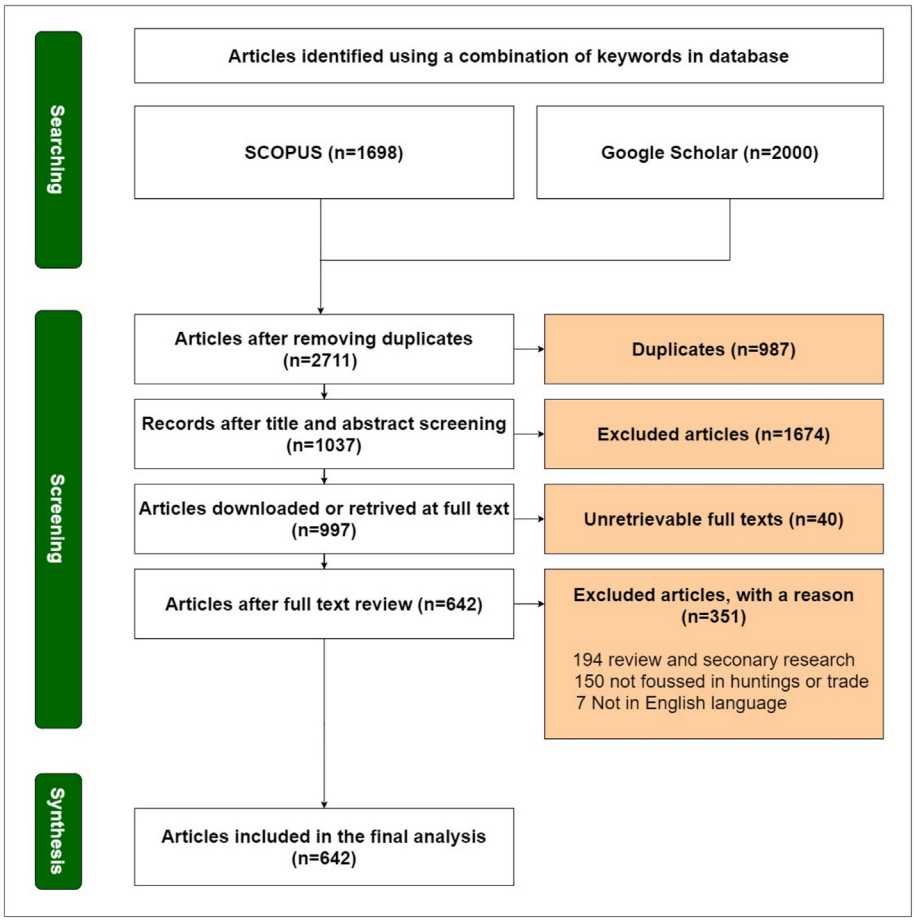


**Fig. 1.** Data collection flowchart.

**Table 1**
Classification of papers included in the final analysis in various categories.

| | |
|---|---|
| Location of hunting and trade | – Continent<br>– World Bank Regions<br>– Country |
| Species involved in hunting/trade | – Family<br>– Order<br>– Species<br>– IUCN's Red List of Threatened Species |
| Drivers of hunting/trade | – Listing reported drivers of wildlife hunting and trade |
| Technique/means of hunting | – Listing reported techniques/means of wildlife hunting |
| Hunting/consumption pattern | – Listing hunting and consumption patterns for given unit separately |

existence of a physical marketplace (18 %), meat consumption (12 %), pet trade/recreation (12 %), medicinal use (10 %), and ornamental use (7 %). Cultural/religious use and income generation each accounted for 6 % of cases. Globalization, market networks, and online trade contributed to 4 %, while poor law enforcement and poverty/unemployment were among the least cited drivers (2 % and 4 %, respectively) (Fig. 4).

There were significant differences among regions in terms of total reported cases of hunting drivers ($X^2 = 1127$, df = 6, $P < 0.001$) and trade drivers ($X^2 = 331.52$, df = 6, $P < 0.001$). Three regions – "East Asia & Pacific"," Latin America & Caribbean", and "Sub-Saharan Africa" – accounted nearly 90 % of the total reported drivers of wildlife hunting (90 %) and trade (87 %) (Fig. 5). These regions did not differ significantly in hunting drivers for "cash income/trade", "cultural/religious use" "medicinal use" and "subsistence consumption" (proportional test, $P$ 0.05) while others were inconclusive due to small sample size. Nigeria, Brazil, and Cameroon were among the top three countries with the most reported hunting to serve for income/trade, cultural and medicinal use. Besides, hunting in India and Vietnam was also reported to be driven by recreation (Fig. 5).

The frequency of wildlife trade drivers among the three regions did not differ significantly for cultural use, income, market demand, medicinal and ornamental use and physical market (proportional test). However, "meat source" and "pet/recreation" differed among these three regions ($X^2 = 11.31$, df = 2, $P = 0.003$), where "Latin America & Caribbean" had significantly high proportion of cases for meat source ($X^2 = 7.08$, df = 2, $P = 0.02$, East Asia and Pacific 7.8 %, Latin America and Caribbean 20 % and Sub-Saharan Africa 14.63 %). "Sub-Saharan Africa" had significantly low proportion of cases for pet ($X^2 = 12.75$, df = 2, $P < 0.0017$, East Asia and Pacific 14 %, Latin America and Caribbean 17 % and Sub-Saharan Africa 3.2 %) (Fig. 5). Brazil and Indonesia were among the top two countries with most reported trade driven by the physical market, pet/entertainment and meat consumption.

### 3.3. Means of hunting

We determined five major means of wildlife hunting based on their nature, use and origin, which included (a) dog (b) modern firearms, (c) poison/chemical (d) traditional weapons and (e) traditional catching techniques. These hunting techniques differed significantly ($X^2 = 256.81$, df = 4, $P < 0.001$), with traditional catching technique making up 46 % of reported cases, followed by modern firearms (27 %), traditional weapons (15 %), dog (10 %) and poison and chemical (2 %). The highest reports of traditional catching were from Sub-Saharan Africa (62 %), followed by East Asia and Pacific (17 %), Latin America and Caribbean (15 %) and South Asia (6%) (Fig. 6).

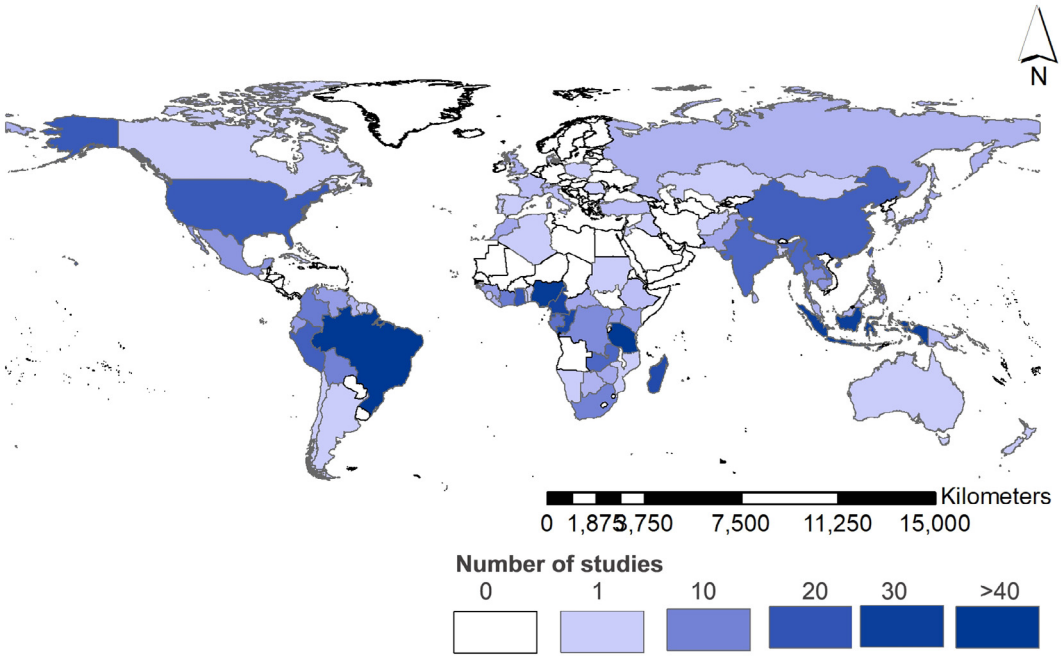


**Fig. 2.** Geographic distribution of research on wildlife hunting and trade by country based on 642 research articles reviewed in our study. The color gradient indicates the number of research articles focused on each country although focus of study area of corresponding article may not necessarily be country. The darker shades represent a higher number of studies.

### *3.4. Taxonomic pattern of wildlife hunting and trade*

A total of 792 species representing 314 orders and 121 families belonging to 10 classes were reported in hunting and trade. The largest proportion of species used in trade and hunting were mammals (14 % of total mammal species in the world), followed by Aves (3 % of total species of aves) and Reptiles (2 % of total species of reptiles). However, the taxonomic coverage in terms of proportion of respective order was highest for reptiles, followed by amphibia, mammals and aves. Still, amphibians were among the least represented at the family level (Fig. 7).

Among 792 species reported in wildlife hunting and trade, the number of species as per IUCN's red list of threatened species differed significantly from expected equal counts ($X^2$ = 869.9, df = 6, $P < 0.001$), where least concerned covered almost half of species (51 %), followed by vulnerable (14 %), endangered (10 %), near threatened (7 %), critically endangered (5 %) and data deficient (2 %). Overall, 29 % of species in our database were threatened (critically endangered, endangered and vulnerable) based on IUCN's red list of threatened species.

## 4. Discussion

Wildlife hunting and trade, among the most pressing global challenges, have multifaceted ramifications ranging from biodiversity loss to public health risks through pathogen spillover. These issues are likely to escalate

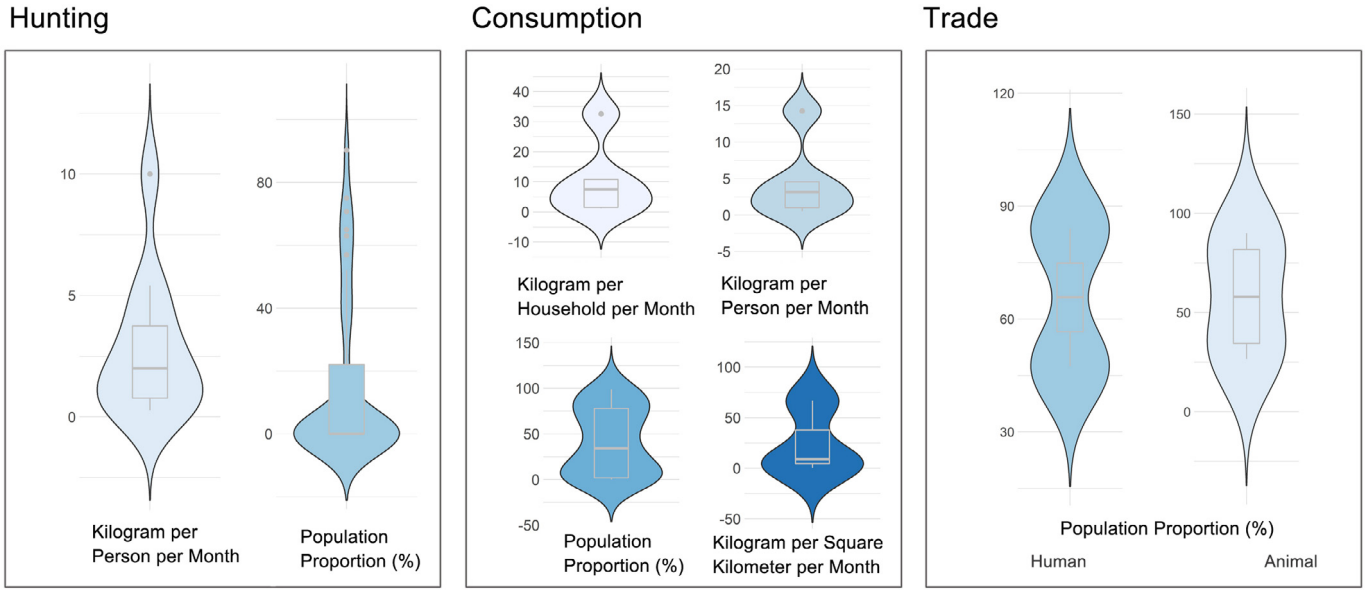


**Fig. 3.** Violin plot showing pattern of wildlife hunting, consumption and trade in terms of amount per person/area/household per unit time and population proportion. The dashed horizontal line indicates the median and vertical lines indicate the lower and upper quartiles.

**Table 2**
Wildlife hunting, consumption and trade in terms of the population proportion, amount per unit time and area (average and standard deviation).

| | Pattern Category | Total (Mean ± SD) | Sub- Saharan Africa (Mean ± SD) | East Asia & Pacific (Mean ± SD) | South Asia (Mean ± SD) | Latin America & Caribbean (Mean ± SD) |
|---|---|---|---|---|---|---|
| Hunting | Population Proportion | 51.72 ± 23.26 | 52.87 ± 27.24 | 58.50 ± 9.19 | 22.00 ± 1.167 | 55.76 ± 21.16 |
| | Kilogram per Person per Month | 2.79 ± 7.167 | 2.51 ± 1.74 | – | – | 3.55 ± 5.58 |
| Consumption | Population Proportion | 41.88 ± 36.63 | 49.73 ± 37.45 | 36.57 ± 40.20 | 28.5 ± 40.30 | 24.89 ± 27.05 |
| | Kilogram per Person per Month | 4.70 ± 5.58 | 2.083 ± 1.53 | – | – | 6.451 ± 7.05 |
| | Kilogram per Household per Month | 10.71 ± 12.87 | 10.71 ± 12.87 | – | – | – |
| | Kilogram per Square Kilometer per Month | 25.23 ± 36.13 | 25.23 ± 36.13 | – | – | – |
| Trade | Population Proportion | 58.12 ±31.08 | 84 ± 7.77 | 65.75 ± 25.81 | – | – |
| | Animal Proportion | 65.75±25.80 | 84.5 ± 7.78 | 26.5 | – | 37 |

further. Numerous contextual and enabling factors drive the use and consumption of wildlife, yet information on these underlying drivers remains scarce. Our review addresses this knowledge gap, providing critical insights into the patterns of wildlife hunting and trade.

### 4.1. Frequency of wildlife hunting, consumption and trade

Our results indicate widespread wildlife hunting and their consumption. The consumption can extend to larger populations, including urban areas, depending on the socio-economic and ecological factors. Recent studies have also shown a similar pattern across the globe. Bizri et al. (2024) reported widespread illegal sport hunting throughout Brazil, which has led to the depletion of medium- and large-bodied species and a shift in hunting practices toward smaller-bodied vertebrates, such as small birds [44]. McGrath and Behie (2021) noted that 64 % of households participated in hunting activities in Veun Sai-Siem Pang National Park, Cambodia, with a particular focus on primates (38 %) [32]. Borgerson et al. (2021) documented nationwide lemur hunting in Madagascar, with each household consuming more than one lemur per year [31]. Commerçon et al. (2021) found that the proportion of households with hunters ranged between 17 % and 43 % across different villages in Xishuangbanna, China [45]. Wildlife trade is widespread, but data remain limited and often underreported. For example, Emogor et al. (2021) documented the seizure of nearly 0.8 million pangolins in Nigeria between 2010 and September 2021—an amount comparable to global estimates—suggesting a significant underestimation of the true scale of the global pangolin trade [46,47].

We emphasize that our data are based on empirical studies of wildlife hunting and trade conducted in various parts of the world. These areas are typically rich in biodiversity and are home to communities that rely primarily on subsistence livelihoods, and therefore may not be representative of global populations. This is supported by the observation that very few studies originate from Europe and Central Asia, which, however, is not definitive proof of the absence of wildlife hunting here. For example, widespread game meat consumption reported in the Sweden [48]. Nowak et al. (2021) reported illegal killings of wolves in Poland, with simulations estimating the number of wolves killed illegally ranging from 147 to 1134 [49]. Thus, hunting in Europe may occur for subsistence, retaliation, or trade, but these practices are likely underrepresented in academic literature and remain poorly documented. Future research is needed to disentangle the patterns of hunting and consumption at the community level.

### 4.2. Drivers of wildlife hunting and trade

The twelve major drivers of wildlife hunting documented are in consistently similar proportion among major regions: “East Asia and Pacific”, “Latin America and Caribbean”, and “Sub-Saharan Africa” although frequency of driver is varied considerably. The three most common drivers were ‘subsistence consumption’, cash income/trade and religious use. We infer that such pattern corresponds to socio-economic attributes in these regions, which are characterized by diverse community, a high proportion of rural landscape. Wildlife in most of the rural areas are readily available due to their proximity to sources and their consumption is attributed to its availability as a “free common resource” and people's demand for a regular protein source. Notably, cultural use of wildlife is an important driver for their hunting and trade as our result suggest [45,50]. Traditional medicine is one of the extensive sources of wildlife consumption. Traditional Chinese medicine dates back to four to five thousand years [51]. It includes extensive use of body parts of diverse species to make medicine for various ailments [52]. Not only in China, traditional medicine has also been practiced in African countries for centuries [53]. The same wildlife species can have multiple uses: medicine, or consumption for protein source or use in cultural and religious ceremonies. For example, 13 different body parts of pangolins are used in Africa to treat different medicinal ailments, where scales and bones are most valued because of their highest cultural significance, including treatment of different diseases and spiritual protection [53]. Some

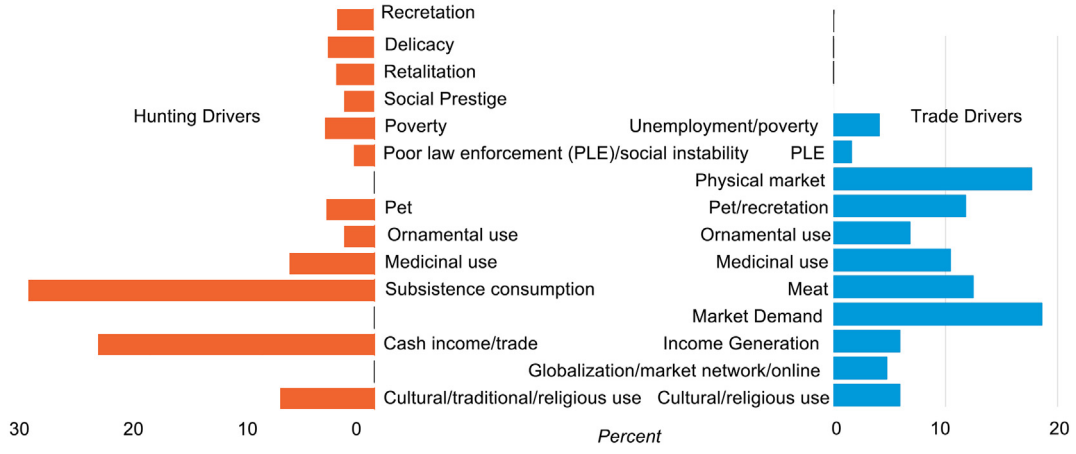


**Fig. 4.** Proportion of cases reported as primary drivers of wildlife hunting (left pane) and trade (right pane). Similar drivers are aligned in the same rows to enable direct comparison between hunting and trade motivations.

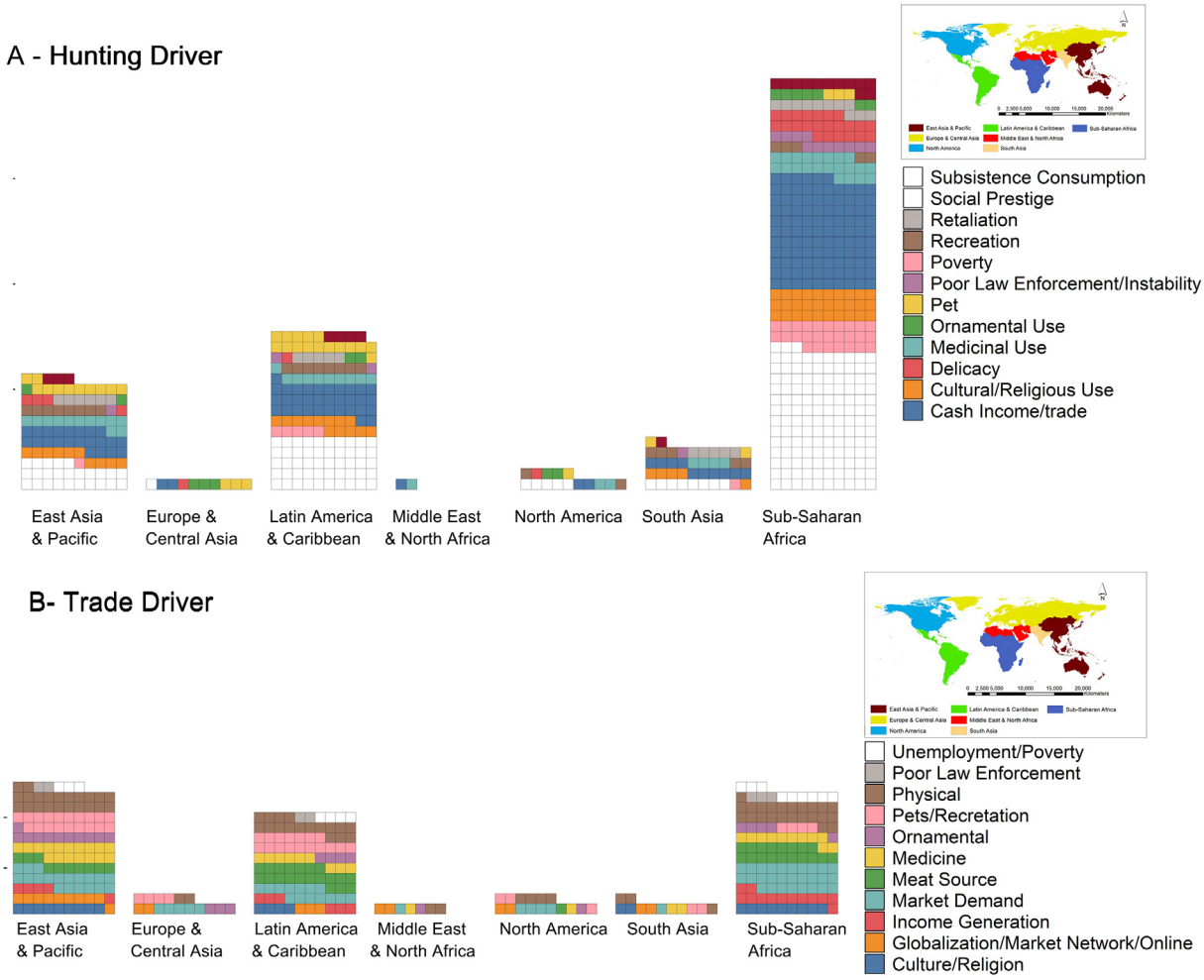


**Fig. 5.** Number of (a) hunting and (b) trade cases in terms of their drivers by regions.

of the species are killed when wildlife is involved in conflicts with human and causes direct or indirect risk to human's wellbeing. Such retaliatory killings are common in human-wildlife conflict hotspots. Carnivores, for example, are retaliated for human fatalities and injuries. Herbivores are also retaliated for crop depredation, but this also serves meat sources. In some cases, the perceived negative views toward wildlife are one of the drivers of people's involvement in hunting, which also motivates the trade of a few high-profile charismatic species such as rhinoceros, elephants and tigers [16].

As suggested by our result, medicinal, pet and ornamental use comprised of higher proportion of cases as a trade driver than in hunting. This is perhaps an indication of law of utility value: the scarcer resources with high utility were traded more. The use of wildlife as pets is common throughout the world and proliferated in urban areas, particularly among younger generations due to media [54]. The choice of species is associated with cultural and traditional practices [55], including their presumed rarity, physical appearance and specific characteristics. Humans have tendencies to develop emotional attachments with animals [56]. Birds, reptiles, and mammals are often kept as pets depending on their use in human entertainment and companionship [57–59].

Besides use value, hunting is also associated with social prestige [60] as a showcase of success and hunting skills [61,62]. Such a tendency was also common in primitive societies were hunting success, particularly hunting large animals, validates one's accomplishments [63]. Wildlife trade is positively linked to the availability of local markets. Countries with a long tradition of wildlife hunting generally have local markets [64] that feed to national, regional and international markets depending upon socio-economic and local characteristics and market demand [65]. For example, the European Union is considered as one of the most significant importers of wild-caught mammals and birds from southeast Asia [34]. The trade of wildlife tends to flow from poor developing nations to more affluent developed nations, and wealth inequality between the two makes the global trade network more connected [57]. With the rapid increase in access and availability of internet-based platforms, including communication tools such as Instagram, Facebook, WhatsApp and blogs, the traditional markets have largely turned into virtual ones, providing a quick, efficient and secrete venue for wildlife trafficking [66], and consequently influencing promotion of illegal wildlife trade [57]. The internet eliminates the need for a 'middleman' by enabling direct wildlife sales to the buyer, making it a convenient medium for illegal wildlife traders to advertise and sell their products anonymously [67]. Trade is exacerbated by growing number of affluence populations with higher purchasing capacity [34].

### *4.3. Means of wildlife hunting*

We determined five major means/techniques of wildlife hunting based on their nature, use and origin, which included (a) dog (b) modern firearms, (c) poison/chemical, (d) traditional weapons and (e) traditional catching techniques where traditional techniques and weapons covered half and one-sixth of reported cases respectively. Hunters may use more than one hunting techniques, and the repercussion of using different hunting techniques on wildlife population is different. Although application techniques vary across locations and societies depending on the type of species in question, their availability and accessibility, including local

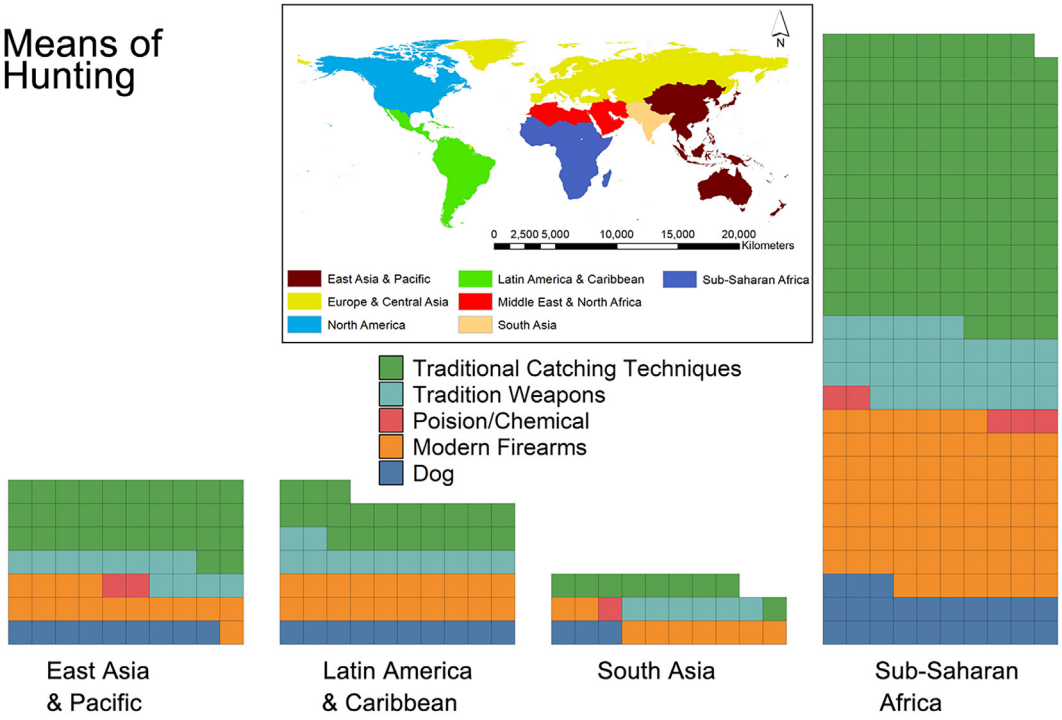


**Fig. 6.** Frequencies of techniques/means of hunting by regions.

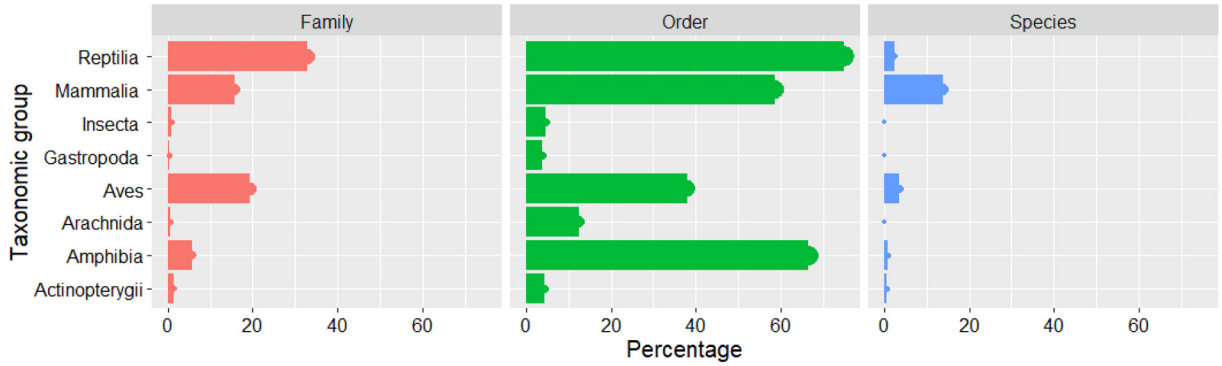


**Fig. 7.** Proportion of records for corresponding family, order and species with respect to their taxonomic group reported in wildlife hunting and trade.

characteristics, we find a consistently similar pattern at the regional scale. The high use of traditional means of wildlife catching techniques (e.g., wire) are almost universal because of their availability and ease of use [68]. Use of poisons or chemicals to hunt wildlife can involve poisoned carcasses as bait, soaking grains in chemical solutions, creating salt licks by combining pesticides and contaminating water holes [69]. Such techniques, however, may cause indiscriminate killings of wildlife due to a lack of selectivity [30]. On the other hand, modern firearms are hard to obtain, expensive, and detectable [68], but they are far more efficient than traditional methods. Use of dogs in hunting is common throughout the world, where dogs facilitate identification, chasing and even capturing animal [70].

### *4.4. Taxonomic pattern of wildlife hunting and trade*

The preference of particular taxa is largely governed by species-specific characteristics and purposes (discussed as drivers of wildlife hunting and trade in earlier sections). Large-bodied species and those readily available ones are often prime targets for meat, such as primates and large flightless birds [36,50], whereas songbirds with attractive voices traded for pet purposes [59]. Some animals with exceptional attributes (e.g., tusks, horns and skull length) are traded for perceived traditional medicinal value [52] and for trophies and decorative items [16,71]. Hunting of a high proportion of reptiles and amphibia both at order and family levels–as compared to other classes– was not surprising given their limited numbers in both levels of the taxonomic classifications. However, entire class and/or family are likely to collapse as target species become scarcer. Reptiles are in high demand for delicacy/food and traditional medicinal uses, including use as pets [24,72,73], and are also relatively easy to conceal and transport as live specimens [67]. There is a correlation between phylogenetic relatedness and remedies in traditional medicines, suggesting similar species in phylogenetic classification are often targeted. Scarce species are again prized more for their rarity [67], which could also justify the proportion of threatened species which are generally rare, involved in hunting and trade. Once target species are depleted, people shift to focus on similar ones, ultimately putting the entire order or class at risk of extinction [30].

A probable cause for high proportion of mammals and aves targeted in hunting and trade could be them providing more products with diverse chemical composition, enhancing their utility in traditional medicine [74], but there is a need for further assessment. A disaggregated analysis of wildlife hunting and trade, each for business and subsistence oriented, is needed, which requires inclusion of socioeconomic covariates (i.e., income, education, ethnicity, and household size). Hunting and trade of rare species, even at low intensity, can greatly impact their populations, accelerating their endangerment.

### 4.5. The way forward

Our findings show a widespread involvement of local communities in wildlife hunting and trade, mainly for subsistence, using traditional tools and targeting non-threatened species for local consumption and livelihood support. Wildlife hunting and trade, in combination with habitat fragmentation and climate change, can significantly impact ecosystems and human well-being in several ways [74]. These activities directly deplete wildlife populations, contribute to faunal collapse, and destabilize ecosystems. Furthermore, they are often linked with other forms of illegal trade, such as narcotics, money laundering, and arms trafficking. Despite their negative impacts, wildlife hunting and trade are also embedded in social and cultural practices, particularly in rural areas where wildlife contributes for food and nutritional security. We advocate for empirical research and evidence-based interventions addressing these dimensions, which remain critically underexplored. Beyond the scarcity of empirical data, we also seek to engage with a central question: should hunting and wildlife trade be entirely banned, or are there trade-offs to consider?

From a conservation perspective, both hunting and trade are major drivers of species endangerment, although their impact varies depending on species-specific traits [75,76]. Carnivores, for example, are more prone to extinction because of their large body size, low density, low recruitment and specialized diet [77], so are reptiles and other less conspicuous species. In some cases, selective hunting (e.g., adult, certain sex or better fit animals) is widely practiced, and such practice not only increases the risk of extinction [78–80] but also causes undesirable evolutionary consequence due to bias in population composition and its consequent impact on fitness-related traits [72,80,81]. Rare and attractive species are high-priced in international markets, which further incentivizes trading them. The conservation need of such species is highlighted by listing them in several categories of extinction risks under IUNC's red list of threatened species [82]. Such assessment could be a benchmark for wildlife management. A tailored made alternative approach covering ecotourism and trophy hunting, depending local circumstances, is needed to benefit both wildlife and communities [83]. Besides, the government needs to acknowledge community reliance on wildlife to meet social, cultural and religious needs. A blanket ban on hunting and closing down market risk expanding black market, making monitoring and law enforcement extremely difficult. We advocate for a transparent and regulated system for wildlife hunting and trade, supported by effective and context-sensitive enforcement mechanisms.

Several pathogens in bushmeat are found to be zoonotic, and transmission from animals to humans can occur through direct or indirect contact [13,14,84–86]. Therefore, wildlife hunting and trade, including activities in wet markets, increase the probability of cross-species transmission and play an important role in disease emergence [87]. The majority of past pandemics in recent decades, such as severe acute respiratory syndrome (SARS), Middle East respiratory syndrome (MERS) and COVID-19, originated in wildlife and are increasing significantly over time [10]. Given the links between wildlife hunting and trade and spillover risk [13,14], interdisciplinary research is essential to evaluate the threat and guide evidence-based public health policy [11]. The One Health framework acknowledges such interconnections among environmental degradation, wildlife health, and the emergence of zoonotic diseases [88], and therefore needs to be broadly implemented.

## CRediT authorship contribution statement

**Prakash Kumar Paudel:** Writing – original draft, Visualization, Validation, Methodology, Formal analysis, Data curation, Conceptualization. **Dibas Shrestha:** Writing – review & editing, Writing – original draft. **Rashila Deshar:** Writing – review & editing.

## Ethical approval

Not applicable.

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## Declaration of competing interest

The authors declare that they have no competing interests.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ecofro.2025.06.005.

## Data availability

All data have already been included in the manuscript.

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