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Cover: A Warty Hammer Orchid *Drakaea livida* gets pollinated by a male thynnine wasp through 'sexual deception' — a colour pencil reproduction of photos by ron_n_beths (flickr.com) and Rod Peakall; Water colour reproduction of Flame Lily *Gloriosa superba* -- photo by Passakoran_14; and a bag worm and its architectural genius (source unknown). Art work by Pannagasri G.

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REVIEW

Understanding the ethnozoological drivers and socioeconomic patterns of bird hunting in the Indian subcontinent

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Abstract: Bird hunting and trade pose major threats to avifauna in the Indian subcontinent. Although prohibited under the Indian Wildlife Protection Act of 1972, bird poaching has continued, driven primarily by demand from the pet trade, traditional medicine, and cultural beliefs. This study systematically reviewed literature on the socioeconomic and ethnozoological drivers of bird hunting, and trade across India, Pakistan, Nepal, Bhutan, Bangladesh, and Sri Lanka. Around 124 publications were analysed to examine bird use, socioeconomic drivers, and poaching trends. Keywords including “zootherapy,” “ethnozoology,” “traditional uses”, and “bird trade” were used to identify relevant studies on bird hunting with Google Search, Scopus, and Web of Science. A linear regression analysis revealed a significant negative correlation between the sub-national human development index and the number of species hunted at the state level, while, factors like indigenous population size, and state gross production per capita did not significantly impact hunting prevalence. A chi-square test for independence revealed that subsistence hunting in India was less than expected, with cultural, and commercial factors being more significant drivers of hunting. The pet trade was a key driver of poaching in India and Bangladesh, while traditional falconry in Pakistan severely affected raptor populations. A strong positive correlation was found between the number of studies per state and reported hunting prevalence, highlighting geographical, and temporal biases in research. A more comprehensive analysis is needed to fully understand bird hunting patterns, integrating government seizure records, NGO rescue data, CITES trade data, and online media sources.

Keywords: Bird conservation, bird poaching, ethnoornithology, ethnozoology, exotic bird trade, indigenous hunting, illegal wildlife trade, subsistence hunting, wildlife crime, wildlife hunting.

Hindi: भारतीय उपमहाद्वीप में पक्षी शिकार और व्यापार पक्षी-जीवों के लिए बड़े खतरे हैं। यद्यपि भारतीय वन्यजीव संरक्षण अधिनियम, 1972 के तहत यह प्रतिबंधित है, फिर भी पक्षी शिकार जारी है, जो मुख्य रूप से पालतू व्यापार, पारंपरिक चिकित्सा और सांस्कृतिक मान्यताओं की मांग से प्रेरित है। इस अध्ययन ने भारत, पाकिस्तान, नेपाल, भूटान, बांग्लादेश और श्रीलंका में पक्षी शिकार और व्यापार के सामाजिक-आर्थिक और नृजातीय-प्राणी-वैज्ञानिक कारकों पर साहित्य की व्यवस्थित समीक्षा की। पक्षियों के उपयोग, सामाजिक-आर्थिक कारकों और अवैध शिकार के रुझानों की जाँच के लिए लगभग 124 प्रकाशनों का विश्लेषण किया गया। Google सर्च, स्कोपस और वेब ऑफ साइंस के साथ पक्षी शिकार पर प्रासंगिक अध्ययनों की पहचान करने के लिए "प्राणी-चिकित्सा", "नृजातीय-प्राणी-विज्ञान", "पारंपरिक उपयोग" और "पक्षी व्यापार" जैसे कीवर्ड का उपयोग किया गया। एक रेखीय समाश्रयण विश्लेषण से उप-राष्ट्रीय मानव विकास सूचकांक और राज्य स्तर पर शिकार की जाने वाली प्रजातियों की संख्या के बीच एक महत्वपूर्ण नकारात्मक सहसंबंध का पता चला, जबकि स्वदेशी जनसंख्या के आकार और राज्य के प्रति व्यक्ति सकल उत्पादन जैसे कारकों ने शिकार की व्यापकता को महत्वपूर्ण रूप से प्रभावित नहीं किया। स्वतंत्रता के लिए एक चि-स्क्वायर. परीक्षण से पता चला कि भारत में निर्वाह हेतु शिकार अपेक्षा से कम था, और सांस्कृतिक एवं व्यावसायिक कारक. शिकार के अधिक महत्वपूर्ण चालक थे। भारत और बांग्लादेश में पालतू जानवरों का व्यापार अवैध शिकार का एक प्रमुख कारण था, जबकि पाकिस्तान में पारंपरिक बाज़ शिकार ने शिकारी पक्षियों की आबादी को गंभीर रूप से प्रभावित किया। प्रति राज्य अध्ययनों की संख्या और. शिकार की व्यापकता की रिपोर्ट के बीच एक मजबूत सकारात्मक सहसंबंध पाया गया, जिससे शोध में भौगोलिक और लौकिक पूर्वाग्रहों पर प्रकाश डाला गया। पक्षियों के शिकार के पैटर्न को पूरी तरह से समझने के लिए, सरकारी ज़ब्ती रिकॉर्ड, एनजीओ बचाव डेटा, सीआईटीईएस व्यापार डेटा और ऑनलाइन मीडिया स्रोतों को एकीकृत करते हुए, एक अधिक व्यापक विश्लेषण की आवश्यकता है।

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THINK WILDLIFE FOUNDATION

INTRODUCTION

Bird hunting and trade pose a significant threat to avifauna across the Indian subcontinent, driven by a range of cultural, economic, and commercial factors (Bhupathy et al. 2013; Roy et al. 2024) . Despite the existence of legislation such as the Wild Life (Protection) Act that prohibits the poaching and trade of wildlife, a study analyzing 182 media reports documented the seizure of 25,850 birds across 109 incidents (Poonia et al. 2022). The illegal bird trade persists due to demand from the pet market, traditional medicine (zootherapy), cultural beliefs (Solavan et al. 2004; Yesodharam et al. 2011; Velho & Laurance 2013; Vijaykumar et al. 2015), subsistence hunting, and sport hunting (Selvan et al. 2013; Das et al. 2017; Ahmed et al. 2021).

The use of birds in traditional medicine is widespread across the Indian subcontinent, reflecting broader global trends. The World Health Organization (WHO) estimates that 80% of the global population relies on traditional medicine, including zootherapy (WHO 2022). In northeastern India, 24 bird species have been documented as being used by 17 ethnic groups to treat 37 diseases (Das et al. 2017). Similarly, in Bhutan, five bird species are commonly used in Sowa Rigpa Medicine (Yeshi et al. 2021). Bird use in ethnopharmacology is prevalent across Nepal and Pakistan as well (Lalramnghinglova 1999; Negi & Palyal 2007; Lohani 2010, 2012; Lokwani 2011; Tynson et al. 2012; Paudyal 2014; Paudyal & Singh 2014; Kushwah 2017; Shoukat et al. 2020; Adhikari et al. 2020, 2023; Ahmad et al. 2021; Kunwar 2024). Beyond medicinal use, superstitious rituals and religious practices also drive the poaching of certain species. For example, the Mottled Wood Owl *Strix ocellata*, and Brown Fish Owl *Bubo zeylonensis* are frequently targeted for illegal trade in India during the Diwali festival, where they are used in black magic practices (Ahmed 2010).

Hunting for sport and captive breeding further exacerbates the decline of several bird species. In Pakistan, the hunting of the Houbara Bustard *Chlamydotis undulata* has surged as its populations have declined in the Middle East and northern Africa, making the country a key destination for Arab falconers (Tourenq et al. 2005). The live capture of raptors, including the Laggar Falcon *Falco jugger*, and White-eyed Buzzard *Butastur teesa*, has also increased due to high mortality rates in falconry, further driving illegal poaching in Pakistan (Mohan & Athreya 2011). Meanwhile, in both Nepal and Bangladesh, there have been numerous records of bird and wildlife poaching for ethnozoological purposes (Poudel & Singh 2016; Barkat et al. 2021).

In India, subsistence hunting remains a significant driver of bird poaching in some regions. For instance, in Pangti Village, Wokha District of Nagaland, the massacre of Amur falcons *Falco amurensis* was driven for local consumption, and for sale in a nearby market (Mero & Mishra 2022). Despite the prevalence of bird hunting across the Indian subcontinent, limited efforts have been made to synthesize available data at a national scale. Research on bird poaching is often localized within a specific state or district or included as part of broader wildlife trade analyses (Niraj et al. 2012; Poonia et al. 2022; Singh 2023).

This literature review aims to consolidate and analyse the socioeconomic and ethnozoological drivers of bird hunting and trade in the Indian subcontinent, covering India, Bhutan, Nepal, Pakistan, and Bangladesh. Maldives, though a part of the Indian subcontinent, is not included in the study due to a lack of publications on the topic. Specifically, the review aims at identifying the ethnozoological uses of birds, including traditional medicine, and cultural practices. Additionally, it investigates the correlation between income levels, the subnational human development index (SHDI), and bird hunting prevalence at a subnational level. SHDI is a more comprehensive socioeconomic factor than household income, which incorporates factors like education, standard of living, and health. Lastly, the review identifies patterns in bird trade, including available data on species hunted, trade quantities, pricing, trade routes, and involvement of tribal communities.

Furthermore, this review seeks to identify critical knowledge gaps and data limitations in existing literature. By incorporating insights from both peer-reviewed studies and technical reports (e.g., TRAFFIC, WWF), this study aims to provide a comprehensive assessment of bird poaching trends, and their implications for conservation efforts in the region.

METHODS

Literature search

The preliminary literature search was conducted using the search terms “bird trade” and “bird hunting” on Google Search, Scopus, and Web of Science databases. The initial search was limited to articles covering bird hunting and trade in India, as this was the initial scope of the project. Only 11 articles were found in India for these specific keywords. Therefore, the geographic scope of the search was expanded to all countries in

the Indian subcontinent, including Pakistan, Bhutan, Nepal, Bangladesh, and Sri Lanka. This resulted in an additional 14 articles on the topic of bird hunting and trade, bringing the total to 25 publications.

Snowballing techniques were used to identify other potential primary keywords related to bird hunting in the region from references cited in the preliminary papers on "bird hunting" and "bird trade". From these papers, a recurring theme of literature cited was the traditional use of birds by indigenous communities. Phrases such as "zootherapy", "ethnozoology", "traditional uses", and "ethnopharmacology" were identified as key search terms. Literature with these themes was in the scope of this literature review, which aimed to identify the drivers, uses, and patterns of bird trade and hunting in the region. While these keywords did produce studies solely focused on the traditional uses of birds, many papers were more generic and included wildlife as a whole. Additionally, numerous papers on the generic themes of "bird conservation", "illegal wildlife trade", and "wildlife hunting" were also identified. From the search results, any article within the geographical scope that contained the trade, hunting, or ethnozoological use of at least one species of wild bird was utilized for the study (Mirin & Klinck 2021). Publications without explicit reference to the trade, hunting, or use of a single avian species were not utilized for the literature review. The distribution of literature across keywords is illustrated in Table 1.

Table 1. Number of Publications Retrieved by Keyword: Various keywords were applied in Google Scholar, Web of Science and Scopus to compile information on the drivers of bird hunting and trade in the Indian subcontinent.

Keyword	Number of results
Bird Trade	13
Bird Hunting	12
Bird Conservation	10
Ethnopharmacology	22
Ethnozoology	24
Illegal Wildlife Trade	8
Wildlife Traditional Uses	12
Wildlife Hunting	9
Zootherapy	14

The literature review was not limited only to peer-reviewed publications. Technical reports from organizations, such as TRAFFIC and WWF, were also utilized for this publication. Preprint repositories such as bioRxiv and ResearchSquare were also searched, using all the mentioned keywords. The literature review also aimed to identify temporal patterns in bird hunting and trade in the region. Therefore, there was no criterion regarding the timeframe within which a study was published. The earliest study included was published in 1986 (Mian 1986). All relevant studies published until November 2024, was included in this study.

Zotero has a built-in duplicate detection feature that was utilized to prevent the duplication of publications in the literature review. Additionally, a manual review of the citation was also conducted to remove duplicate publications (Mirin & Klinck 2021). In total 124 publications were used for the literature review, that includes 120 peer-reviewed publications, two preprints, and two technical reports.

Literature review data collection

A wide array of information was extracted from each source, including metadata of the study, such as study location, data collection methods, year of publication, and, where relevant, the ethnic groups interviewed.

The studies were further categorized by geographical scale, ranging from local to international levels. Local-level studies were confined to a single jurisdiction below the district level, such as a forest division, city, village, or market. District and state-level studies encompassed multiple locations within a district or state, respectively. Regional studies spanned two or more states within a single country, while national-level studies examined wildlife trade across an entire country. International-level studies included research conducted across multiple countries.

This literature review incorporated studies employing both primary and secondary data collection methods. Primary methods included local interviews and market surveys, whereas secondary methods relied on government seizure records, crime data, and news reports. Additionally, species-specific data were compiled from each source, covering bird species involved in trade, hunting, or seizures. The scientific names of the recorded species were obtained from HBW-BirdLife Version 5.0 (December 2020), while their conservation status was determined using the IUCN Red List (2024). Additional details, such as the number of seizures, the individual birds involved, trade or hunting purposes, pricing information, the ethnic groups engaged, the body parts used, and any associated ethnozoological beliefs linked to the species.

Socioeconomic data collection

The trends in bird species were compared to various socioeconomic parameters. The first amongst these was

the sub-national human development index provided by the global data index (Global Data Lab 2022).

Another socioeconomic factor utilized in this study was the net state domestic product (NSDP) per capita for each Indian state. This was chosen to identify whether income levels affected the likelihood of hunting birds. The state-wise data were retrieved using the data provided from the Press Information Bureau under the Ministry of Statistics and Program Implementation (Press Information Bureau 2023). Different conversion rates were used because the per capita NSDP values for each state are reported for different fiscal years. Exchange rates fluctuate annually, so applying a single rate for all years would introduce inaccuracies. To ensure a more precise conversion, 2020–21 data was converted using the average exchange rate of ₹74.00 per USD for that year while the 2021–22 data was converted using ₹74.50 per USD (average for that period). Finally, the 2022–23 data was converted using ₹82.00 per USD, reflecting the depreciation of the Indian rupee in that timeframe. Unfortunately, similar state-wise data was not found for the provinces and states of Bangladesh, Pakistan, and Nepal.

As this study aimed at identifying any ethnozoological patterns of bird hunting in the region, the population of scheduled tribes (ST) in each Indian state were also retrieved from the 2011 national census (Ministry of Tribal Affairs 2013). Like NSDP, the state-wise population of indigenous and tribal communities in Bangladesh, Pakistan, and Nepal was not found.

Simple linear regression analysis was conducted to understand how factors such as SHDI, NSDP per capita, and ST population influenced the number of species hunted, and the number of bird hunting records per state. Additionally, a linear regression was conducted to determine the influence of the number of publications on the number of species hunted.

RESULTS

Geographical distribution of literature

India contributed the highest proportion of studies, representing 61% (n = 76), followed by Pakistan with 20% (n = 25), Nepal with 15% (n = 19), and Bangladesh with 4% (n = 5). Bhutan had only one publication, which did not include a recorded list of hunted species. At a subnational level, Arunachal Pradesh had the highest number of publications (n = 12). In fact, there was a disproportionate number of publications from the northeast Indian States, with 23 studies being published from the states of Arunachal Pradesh, Assam, Manipur, Mizoram, Meghalaya, and Sikkim.

In terms of geographical scale, most studies (n = 51) were conducted at the district level. This was followed by state-level (n = 26) and local-level (n = 25) studies. Fewer studies were conducted at broader scales, with nine at the regional level and 12 at the national level. Only one study was conducted at an international level, incorporating data from Bangladesh, Nepal, Pakistan, and India. The geographical distribution of literature is depicted in Figure 1.

Temporal distribution of literature

The earliest study on bird hunting, trade, and poaching dates back to 1986. A significant increase in publications occurred after 2010, with 81% of all studies (n = 106) published in this period, including 76 studies released after 2015. The peak year for publications was 2020, with 13 studies, followed by 2015 with 12. The temporal distribution of these studies is illustrated in Figure 2.

Overview of species hunted

A total of 1,578 records of hunting from 613 bird species were derived from the 124 published articles. The Rock Pigeon *Columba livia* was the most frequently cited species in studies on bird hunting, with 55 citations. It was followed by the House Sparrow *Passer domesticus* and the Indian Peafowl *Pavo cristatus*, each with 38 citations, and the Red Junglefowl *Gallus gallus* with 27 citations. Table 2 presents the 10 most commonly cited species in publications on bird hunting in the region.
Around 64.3% of the hunted species were classified as 'Least Concern' by the IUCN Red List of 2022 (n = 529). This was followed by 35 species classified as 'Near Threatened' and 26 as 'Vulnerable'. Figure 3 represents the distribution of recorded species across the IUCN Red List.

Spatial distribution of hunted species

India had the highest number of hunted species recorded with 490 species, followed by Pakistan, Nepal, and Bangladesh as depicted in Figure 4. The one publication from Bhutan did not provide specific species. The hunted species list often overlapped across countries.

At a sub-national level, the state of Arunachal Pradesh in northeastern India had the highest prevalence of hunting, with 141 hunting records from 110 species. This was followed by Tamil Nadu with 68 species, and Jammu & Kashmir with 33 species.

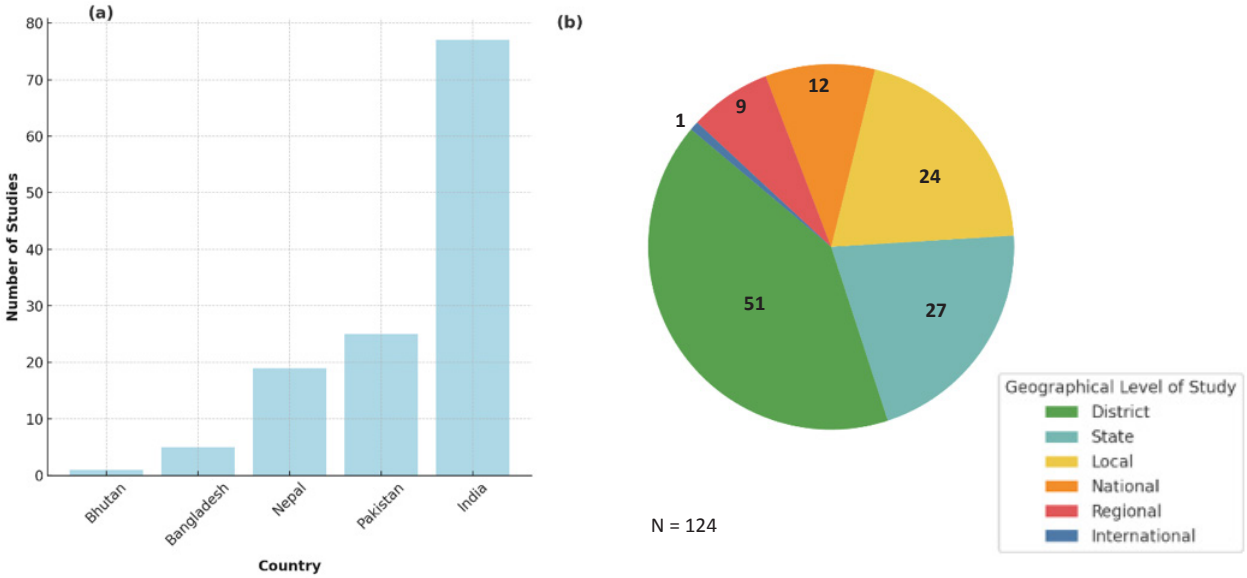

Figure 1. Geographic distribution of published studies on bird hunting, trade and poaching: India had the highest number of publications with 76 studies, followed by Pakistan at a distant second with 24: a—within countries, 51 studies were conducted a district level followed by a state and local with 26 and |b—25 studies.

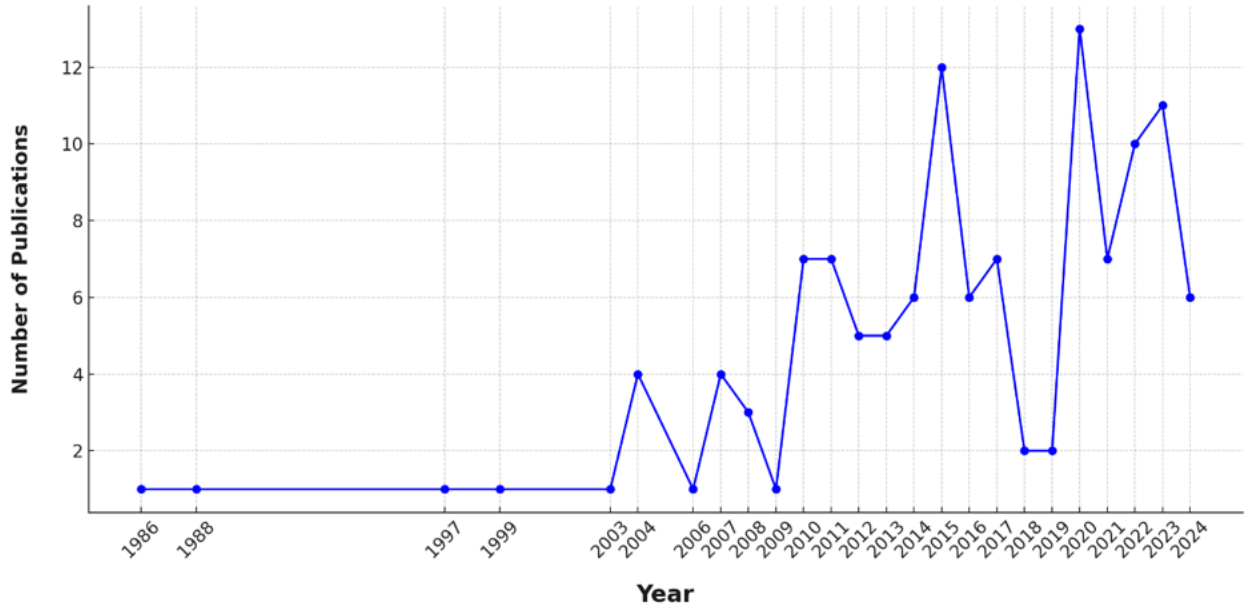

Figure 2. No. of publication on bird hunting, trade, and poaching per year: the highest number of studies were published in 2020 (n = 13), followed closely by 2015 (n = 12).

Correlation between number of studies and species hunted per state

A simple linear regression was conducted to examine the relationship between the number of publication and number of hunted species recorded in each state. A significant positive correlation was recorded between the number of hunted species recorded in a state and the number of studies. Specifically, for each additional study conducted within a state, the number of hunted species recorded in the state increased by 9.06 species (F-statistic = 39.47, df = (1,44), $p < 0.01$). The model explains 47% of the variation. This relationship is illustrated by Figure 5.

Relationship between sub-national human development index and bird hunting

A simple linear regression analysis was performed to assess the relationship between the SHDI and the number of hunted species recorded in each state. The results indicated a significant negative correlation, with the number of hunted species decreasing as SHDI increased (F-statistic = 4.77, df = (1,44), $p < 0.05$). The model accounted for 10% of the variation in the number of hunted species. Figure 6 represents the relationship between SHDI and the number of hunted species.

Relationship between net state domestic production per capita and bird hunting

A linear regression analysis was conducted to estimate the correlation between number of species hunted with the net state domestic product per capita (USD) across each Indian state. A negligible insignificant negative relationship was detected as NSDP per capita only determined 0.3% of the variation in number of species hunted in each state (F-statistic = 0.08, df = (1,44), p-value = 0.769). Similarly, no significant correlation was detected between NSDP per capita and number of bird

Table 2. Ten most frequently cited species for hunting in published literature from the region. The number of citations refer to the number of studies that identified the hunting of the species.

Common name	Scientific name	Order	IUCN Red List status	Number of citations
Rock Pigeon	*Columbia livia*	Columbiformes	Least Concern	55
House Sparrow	*Passer domesticus*	Passeriformes	Least Concern	38
Indian Peafowl	*Pavo cristatus*	Galliformes	Least Concern	38
Red Junglefowl	*Gallus gallus*	Galliformes	Least Concern	27
House Crow	*Corvus splendens*	Passeriformes	Least Concern	21
Great Hornbill	*Buceros bicornis*	Bucerotiformes	Vulnerable	17
Common Mynah	*Acridotheres tristis*	Passeriformes	Least Concern	17
Common Quail	*Coturnix coturnix*	Galliformes	Least Concern	16
Spotted Dove	*Spilopelia chinensis*	Columbiformes	Least Concern	15
Large-billed Crow	*Corvus macrorhynchos*	Passeriformes	Least Concern	14

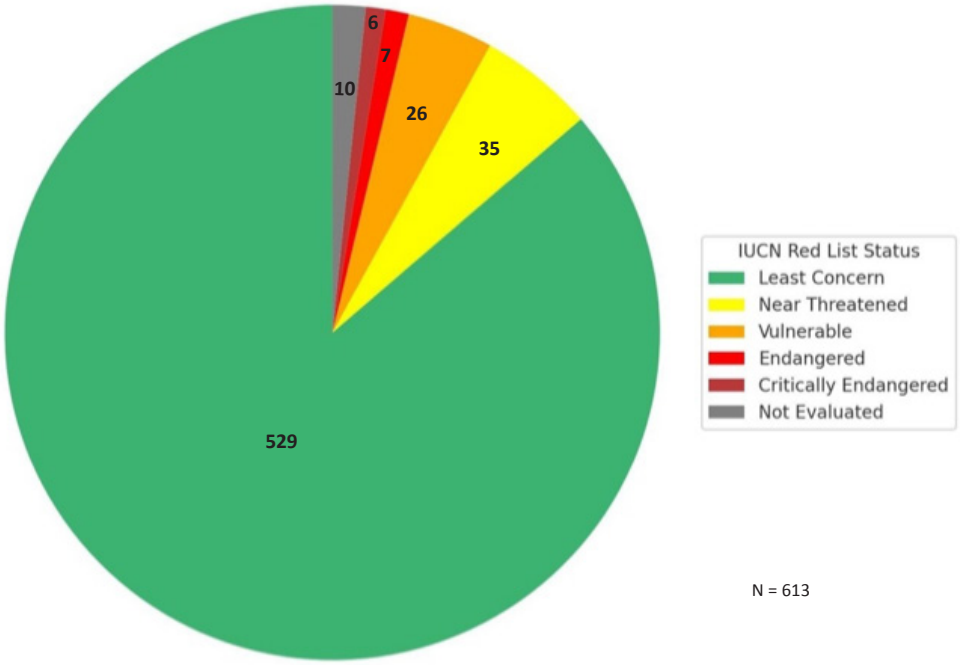

Figure 3. Distribution of recorded species across the IUCN Red List: 529 species were classified as "Least Concern", followed by 35 as "Near Threatened", 26 as "Vulnerable", seven as "Endangered" and six as "Critically Endangered". Around 10 species were classified as "Not Evaluated.

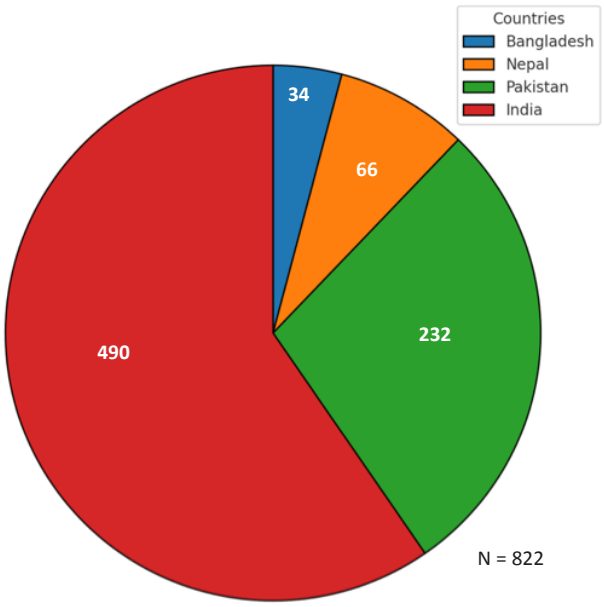

Figure 4. No of hunted birds reported from each country: India recorded the highest number of hunted species (n = 490), followed by Pakistan (n = 232), Nepal (n = 66), Bangladesh (n = 34).

hunting records in each state (F-statistic = 0.07, df = (1,44), p-value = 0.797).

Relationship between state-wise schedule tribe population and bird hunting

A total of 92 tribal communities were recorded to be involved in the trade, hunting, and poaching of birds across the region. The Mughal, Sayed, Sheik, and Malik communities of Pakistan were recorded with the highest number of species hunted (117 each).

A simple linear regression analysis was conducted to examine the relationship between the population of tribals and the number of species hunted in each state. The analysis was limited to the ST population in each Indian state as the state-wise population of indigenous and tribal communities of Pakistan, Nepal, and Bangladesh were not found. Results show a very weak and insignificant negative relationship between the number of species hunted and the ST population (F-statistic = 0.1289, df = (1,44), p-value = 0.722), with the model explaining only 0.4% of the variation in species count.

Similarly, a separate linear regression was performed to analyse the relationship between the ST population and the number of bird hunting records in each state. The findings indicated that the ST population accounted for only 0.2% of the variation in hunting records, again showing an insignificant negative relationship (F-statistic = 0.06, df = (1,44), p-value = 0.808).

Drivers of bird hunting across countries

A chi-squared test of independence was conducted to examine whether the distribution of the bird use categories varied significantly across India, Pakistan, Bangladesh, and Nepal. The test revealed a highly significant difference (χ^2 = 415.47, df = 18, $p < 0.0001$), indicating that the differential utilization of species differed significantly across countries.

The observed and expected frequencies revealed significant deviations across specific use categories. Pakistan recorded 190 instances of birds being used for cultural purposes, markedly exceeding the expected count of 92.3. Similarly, India showed a disproportionately high number of records in the pet trade (observed = 267, expected = 198.0), and zoo trade (observed = 22, expected = 12.6). In contrast, Bangladesh had significantly fewer records than expected across most categories, with zero recorded instances for medicine and food, compared to the expected 8.9 and 2.7, respectively. Lastly, Nepal demonstrated a greater-than-expected reliance on species for medicinal (observed = 63, expected = 35.1), and food purposes (observed = 33, expected = 10.6). Categorization of bird uses for different purposes across countries is illustrated in Figure 7.

DISCUSSION

This literature review aimed to identify the ethnozoological and socioeconomic drivers of bird hunting and trade. Surprisingly, no correlation was found between net state domestic production per capita and the prevalence of bird hunting across different states. This contradicts previous studies that have linked poverty with wildlife poaching and crime in regions such as the Serengeti (Harrison et al. 2015), the Amazon, and the Congo Basin (Choudhury & Talukdar 2023), where bushmeat serves as both a source of protein, and livelihood (Harrison et al. 2015; Choudhury & Talukdar 2023). Notably, in Uganda, poverty alleviation has been an effective tool for mitigating wildlife crime, and poaching (Rane & Datta 2015).

While this review did not establish a direct correlation between income and hunting prevalence, findings indicate that hunting activity decreases with an increasing SHDI. This aligns with previous research conducted in Brazil (El Bizri et al. 2024), Europe (Harrison et al. 2015), and central & western Africa (Nasi et al. 2011). Moreover, this literature review found that subsistence was not a primary driver of bird hunting in

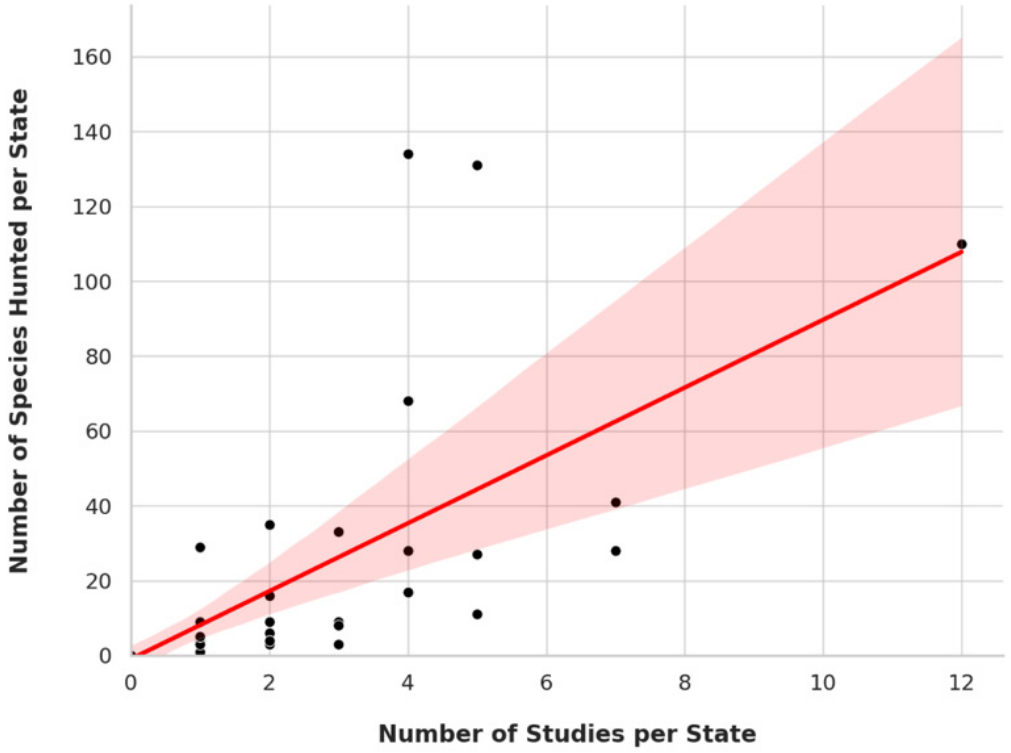

Figure 5. Relationship between the number of publications and the number of hunted species recorded in each state: a significant positive correlation was recorded between the number of hunted species recorded in a state and the number of studies ($p < 0.01$).

Figure 6. Relation between sub-national human development index at a state level and the number of hunted species recorded: a significant positive correlation was recorded between the number of hunted species recorded in a state and the number of studies ($p < 0.01$).

South Asia, suggesting that poverty alleviation alone may be insufficient to curb hunting, and that broader improvements in overall socioeconomic wellbeing are likely more effective. This study found that factors like cultural traditions and commercial wildlife trade were bigger drivers of bird hunting in the region.

For instance, this study found that cultural practices was a major driver for bird hunting in Pakistan, where traditional falconry, and sport hunting has severely impacted endangered bird populations (Ali & Khan 2019; Kumar & Kant 2021; Muhammad et al. 2021; Sadam 2022). Meanwhile, the pet trade was identified as a major driver of bird poaching in India and Bangladesh, surpassing its prevalence in neighbouring countries. This aligns with the growing concern over the commercialization of the domestic wildlife trade and the rising exotic pet market in the region (Ahmed 1997; Singh et al. 2011; Paudel et al. 2020; Poonia et al. 2020; Choudhury & Talukdar 2023; Hinsley et al. 2024; Uddin 2024). The demand for birds as traditional medicine, while existent in South Asia, was not identified as a major driver of bird hunting in this literature review (Mahawar & Jaroli 2006; Mahaway & Jaroli 2007; Mahawar 2008; Quave et al. 2010; Rai & Singh 2015; Negi & Kandari 2017; Ataf et al. 2018; Mughal et al. 2020; Mussarat et al. 2021; Mandal & Rahaman 2022; Shrestha & Bajracharya 2023; Bashir et al. 2023).

Interestingly, in India, bird poaching for cultural purposes was not a major driver of bird hunting, despite its prevalence in Arunachal Pradesh. This possibly could be attributed to India has strict legislation, such as the Wild Life (Protection) Act (1972), and Forest Rights Act (2008), which strictly prohibits traditional hunting (Robinson et al. 2018). Additionally, no significant correlation was found between the population of scheduled tribes and hunting prevalence at the state level in India. Contrastingly, in regions, such as the Peruvian Amazon (Aiyadurai et al. 2010), Indonesia (Francesconi et al. 2018), Malaysia (Tukuboya et al. 2024), traditional hunting practices have contributed to drastic wildlife declines. Similar trends have been recorded in northeastern India as well (Solanki & Chutia 2009; Solanki et al. 2004; Solanki & Chutia 2004; Aiyadurai et al. 2010; Aiyadurai 2012; Singh 2023).

A possible explanation for this unexpected finding is the geographical bias in the reviewed publications. This represents a limitation of the literature review, as a strong positive correlation has been observed between the number of studies conducted and the reported hunting prevalence across states. Notably, around 23% of the analysed studies focused on northeastern India (Lalramnghingloa 1999; Kumar & Riba 2005; Chakravoty et al. 2011; Chinlampianga et al. 2013; Chaudhury et al. 2016; Chowdhury et al. 2017; Betlu 2022).

While traditional hunting has historically posed a significant threat to wildlife in this region, community-led conservation initiatives have achieved remarkable success (Dasgupta 2012; Shepherd et al. 2023). For instance, the Pakke Paga Hornbill festival in Arunachal Pradesh and the Amur Falcon conservation efforts in Nagaland have not only significantly reduced the hunting of these species but also encouraged widespread community engagement in conservation programs (Rane & Datta 2015; Smith & Lee 2024). Similarly, southern India (Dixit 2010; Chellappandian et al. 2014; Gubbi & Linkie 2015; Holennavar 2015; Vijaykumar et al. 2015; Ramachandran et al. 2017; Sinha et al. 2023), and the province of Azad Jammu & Kashmir in Pakistan occupied Kashmir were regions with a substantial number of studies (Hakeem et al. 2017; Faize et al. 2022; Hassan et al. 2022; Faiz & Altaf 2024).

In contrast, only nine studies focused on bird hunting from central and eastern Indian states, including Andhra Pradesh, Bihar, Chhattisgarh, Madhya Pradesh, Odisha, Jharkhand, West Bengal, Telangana, and Maharashtra (Choubey 2021). Although wildlife hunting is prevalent in central India and the Eastern Ghats, there is limited scientific documentation in the region (Benarjee et al. 2010; Rao et al. 2010; Bagde & Jain 2013; Misar & Subhas 2014; Mishra et al. 2020; Gajendra & Tirkey 2020; Samal et al. 2020; Chakraborty & Mondal 2021; Sethi 2022; Patil 2022; Veena & Krishna 2023; Pandey 2024). Provided that these states are among the poorest in India and host significant tribal populations, bird hunting by tribal communities in India is likely to be understated (George et al. 2014).

Additionally, a significant temporal bias was noted in the publications. A majority (61.3%) of the studies were published within the last 10 years, while 85.5% were published within the last 15 years. This temporal limitation restricts the ability to analyse long-term trends in bird hunting. Moreover, it prevents an assessment of whether critical legislative measures, such as the Forest Rights Act and the Wildlife Conservation (Protection) Amendment Act, have had any tangible impact on bird hunting.

While this review provides a broad overview of trends in bird poaching, hunting, and trade, more comprehensive studies incorporating diverse data sources are required. For instance, data from forest departments, the Wildlife Crime Control Bureau, and wildlife rescue centres would offer valuable insights into

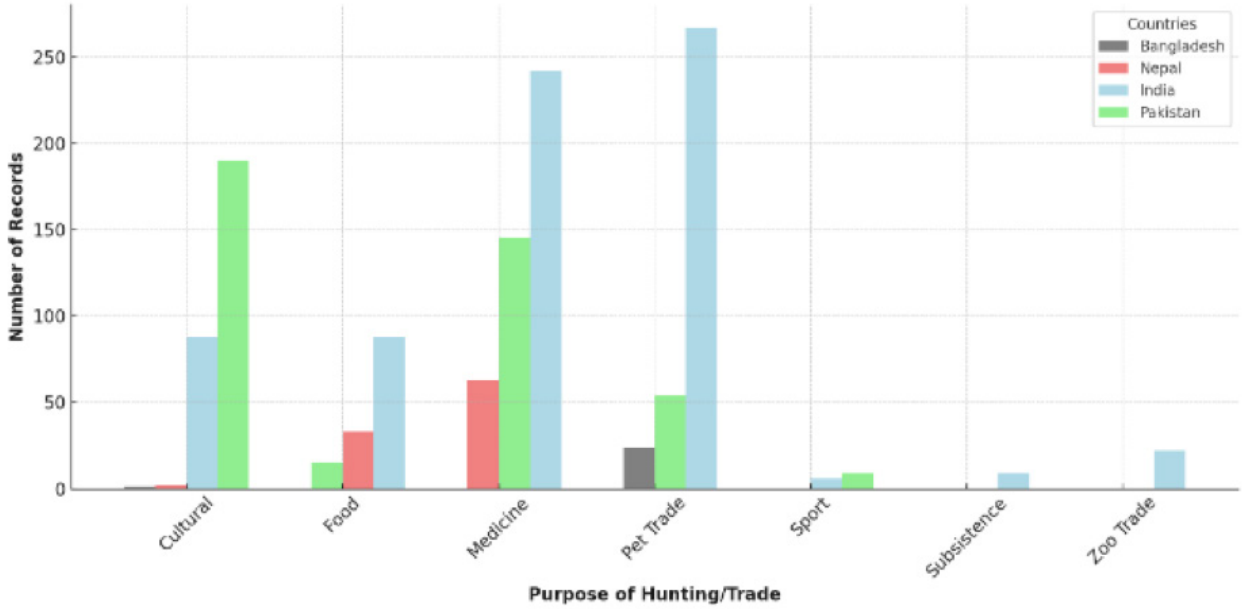

Figure 7. Categorization of bird uses for different purposes across countries. The Chi-Squared test of Independence revealed a highly significant difference amongst use categories.

bird poaching, and seizures at the local level.

Other potential sources include the CITES database, which records the legal international trade of birds, as well as online platforms such as social media, e-commerce websites, and news media reports (Datta 2021), which are increasingly relevant given the rising use of the internet for the exotic pet trade (Massocato et al. 2024). Incorporating seizure and poaching data from these sources will be critical in developing a more holistic understanding of the bird trade in the region. This would be particularly useful, as through the literature review, there was negligible data extracted on the quantity, prices, and trade routes of specimens traded for each species. Lastly, an analysis on specific habitats, such as wetlands, and taxa, such as cranes & parakeets, might provide useful insights, due to the prevalence of habitat, and taxa-specific poaching (Pandit 1988; Tariq 2015; Gosai et al. 2016; Umar et al. 2018; Rehman et al. 2022; Pandey et al. 2024).

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