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Bird trade in Kathmandu: patterns, scale, and conservation concerns

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Abstract

The capture and trade of wild birds is emerging as a significant threat to their conservation worldwide. Nepal serves as a source and a growing transit country for illegal bird trade in South Asia. Birds are one of the most studied groups of wildlife, with research spanning distribution and new species records; however, critical gaps remain in understanding the characteristics of Nepal's bird trade and the legal complexities of its regulation. In response to this knowledge gap, this study provides a comprehensive account of Nepal's wild bird trade, based on market surveys, interviews with traders, analysis of seizure records, and a review of CITES trade data. It also examines the existing legal trade provisions and associated ambiguities and enforcement challenges. We documented 31 bird species in trade, including many globally threatened species, and identified key trade hubs inside the Kathmandu Valley. Notably, we found that the bird trade marketplace has also expanded to digital platforms, adding new challenges for enforcement agencies. Indigenous communities were predominantly involved in supplying and distributing the birds in Kathmandu, with varying levels of conservation awareness and considerable uncertainty about legal requirements. These results are useful for law enforcement and conservation agencies to clarify legislation, prioritise enforcement actions, and develop targeted conservation programs.

1. Introduction

Live wildlife, their parts and derivatives are experiencing growing demand in the market and are often traded for various purposes, including food, medicine, pets, ornamental plants, and as status symbols (1). The legal wildlife trade is valued at approximately USD 220 billion annually, representing a significant global economic activity (2). Legal trade is often implicitly treated as sustainable. Yet, numerous studies show that legally harvested and exported products can still be unsustainable and drive population declines in birds and other taxa (3–5). Illegal wildlife trade (IWT) is closely linked to legal trade, as often it is not clear if the wildlife is sourced legally and sustainably (6, 7). Further, legal markets frequently provide cover for grey and illegal trade, as protections, quotas, welfare rules, and transport restrictions are only partially followed even where legislation exists (8, 9). Both legal and illegal trade pose a significant threat to bird conservation, as even legally permitted harvest and export can drive unsustainable population decline. IWT is often considered the fourth-largest global illegal trade, following narcotics, human trafficking, and counterfeit products driving extinction risk to many species worldwide (3, 10–12). For example, the population of Yellow-breasted bunting *Emberiza aureola* declined by 84.3–94.7% between 1980 and 2013 due to trapping, consumption, and trade in its passage and non-breeding ranges (13). The WorldWise database, spanning 1999 to 2021, includes seizure records for approximately 336,000 instances across nearly 4,000 species, indicating that much of the wildlife trade is illicit (1). This includes some of the most threatened and iconic wildlife from across the globe.

Recent research has shown that wildlife trade has rapidly expanded on online platforms, where monitoring and enforcement are more difficult than in conventional markets (14) (15). In response to these challenges, recent research has moved beyond traditional market-based surveys to incorporate multiple complementary data sources for monitoring wildlife trade. For example, Di Minin et al. (16) demonstrate that systematic monitoring of social media platforms can reveal trade dynamics and spatio-temporal patterns that are often overlooked by conventional field-based approaches. Empirical studies of Asian bird markets further show that large volumes of live birds are traded through ostensibly legal markets, where legality varies by species, origin, and permit status, and is often difficult to verify in practice (9). Consequently, integrative approaches that combine market surveys, seizure records, permit or quota data, and online monitoring are increasingly recognised as essential for disentangling legal and illegal components of wildlife trade and for capturing the full scope of trade dynamics (9, 17).

The Asia-Pacific region, which includes Nepal, is highly biodiverse, with 16 of the global 36 biodiversity hotspots. This region is, however, under threat from drivers such as unsustainable resource use, illegal wildlife trade, habitat fragmentation, invasive and alien species, pollution, and climate change (18). The Himalayan region is often highlighted as one of the key epicentres of wildlife trade (4, 19).

At least 45% of birds are traded to some extent, making it the most overexploited and traded taxa globally (20). Bird species are admired for their vibrant plumage, mimicry and singing abilities, companionship, and intelligence, which push them into the exotic pet trade (21). Birds are often linked to culture in South Asia; the Barn owl *Tyto alba*, for example, is worshipped, considered the vehicle of Goddess Laxmi, the Hindu goddess of wealth (22). The culture of birdkeeping and trade has a long history in South Asia (23, 24), and trade volume has increased in recent years (24).

In South Asia, Nepal is at the centre of trade crossroads, located between China and India, and is also a global biodiversity hotspot experiencing significant poaching and illegal wildlife trade (25). Although the national legislation - National Parks and Wildlife Conservation Act, 1973, Control of International Trade of Endangered Wild Fauna and Flora Act, 2017 and Forest Act, 2019 mentions the trade of wildlife to be illegal without permission, poaching for bushmeat and wildlife parts for trade has long been practised (26, 27). The target species are those valuable in the illegal market, such as rhinos, tigers, leopards, elephants, pangolins, birds, and turtles (28). Birds, in particular, are among Nepal's most traded and overexploited wildlife species, with approximately 29% of Nepal's threatened birds affected by poaching or trapping (29). However, they are often not recorded and reported, resulting in limited understanding of the extent of this growing problem.

Despite such dire conditions, most of the bird-related research in Nepal is skewed toward the status, distribution and new records of species (30–37). Thus, significant knowledge gaps exist regarding this threat, its nature, priority locations, and enforcement complexities. Detection of trade locations is imperative to target enforcement activities. Also, illegal trade can be curbed, and current policy loopholes addressed with the support of clear legislation.

Kathmandu Valley is a primary commercial hub; wildlife products from across Nepal are likely to converge there for trade and redistribution (38–42). However, this does not imply that all national trade passes through the valley, nor does it provide direct evidence of international trade routes. Despite various reports and anecdotes about illegal wild bird trade in the Kathmandu Valley, most of this information remains unpublished, hindering a comprehensive understanding of the trade's scale and impact. To fill these gaps, we conducted a market survey, analysed seizure records, reviewed CITES trade data, and systematically analysed social media. Specifically, we aimed to identify major species and trade hotspots, as well as trader demographics, and evaluate the regulatory concerns associated with bird trade in Kathmandu. The findings of this study highlight the need for legal reforms, awareness-raising and behaviour-change programs, and targeted enforcement to curb the rampant wild-bird trade in Nepal.

2. Methods

2.1. Study area

The study was carried out in Kathmandu Valley, the capital city of Nepal (Fig. 1). The Kathmandu Valley lies at latitudes 27°32'00" N to 27°49'16" N and longitudes 85°13'28" E to 85°31'53" E, covering three districts: Kathmandu, Bhaktapur and Lalitpur. NSO (43) reports that the valley is home to approximately 3.02 million residents and serves as a key trade hub for the country.

Kathmandu Valley was selected as the focal study area because it is the primary urban and commercial hub of Nepal, where wildlife products from different parts of the country are likely to converge for trade and redistribution (38, 41). As the largest market centre with high consumer demand and connectivity to national and international routes, the Kathmandu Valley serves as a key hub for wildlife trade (42). While it is not assumed that all trade passes through Kathmandu, its central role makes it a strategic location for capturing Nepal's dominant trade patterns.

2.2. Data collection

This study used a combination of primary and secondary data sources, integrating qualitative and quantitative approaches. Primary data collection included interviews with bird traders. Secondary data comprised information on legal trade (sourced from CITES trade data) and illegal trade (derived from seizure records). Additionally, we conducted systematic online media

reviews and physical market surveys to collect data on bird trade dynamics, focusing on trade in live birds and associated derivatives (e.g., feathers). The trade in birds for food as in consumption was not systematically surveyed and is not addressed in this study's scope.

2.2.1. Market survey and trader interviews

First, we identified 19 sites within the Kathmandu Valley as potential bird-trade markets based on existing literature and historical accounts of the bird trade. Across the 19 potential sites, 38 visits were conducted between 9 and 30 January 2022. A reconnaissance survey was conducted at these sites to observe bird-trade activities and confirm active locations. Following this, an initial assessment, market surveys, and trader interviews were conducted at sites where evidence of bird trade activity (for example, live birds, trophies, or derivatives) had been observed.

Trader interviews were carried out between 9 and 30 January 2022. Each site was visited at least once during the period, with an additional two to three follow-up visits to locations where active trade was detected.

We identified traders during reconnaissance and subsequent visits based on their involvement in bird trade activities. A total of 34 traders were approached opportunistically. Of these, we only received consent from 27 traders who participated in the interview. Given the sensitive and potentially illegal nature of trade, participation was voluntary and anonymous, which constrained sample size.

Each interview lasted around 30 minutes and was led by the first author. We used a semi-structured questionnaire (Supplementary Materials 1) to collect details on traded species, trade volumes, trade routes, trader demographics, and their awareness of legal frameworks governing bird trade. The interviews were conducted opportunistically in Nepali, following methodologies outlined in studies (44, 45) where researchers combined direct market observation with opportunistic informal questioning of traders about bird trade.

The majority of species identification during market surveys was carried out on-site by the lead author, who has expertise in bird identification. For species or trophies that could not be identified in the field or where identification was uncertain, photographs and videos were taken and reviewed by bird experts Carol Inskipp and Tim Inskipp, authors of *Birds of Nepal*.

In addition to interviewing traders, we reviewed relevant legislation which includes at least xxxx documents ranging from [write some names for reference may be CITES Act 2019, Forest Act xxxx]. We also interviewed the CITES Management Authority and frontline enforcement officials (n = 3) to better understand legal complexities and enforcement practices.

2.2.2. Review of seizure records

We collected data on bird seizures in Nepal (2011 to 2021) from multiple sources to improve completeness and reliability. Seizure records were obtained from Division Forest Offices (DFOs) in Kathmandu, Bhaktapur, and Lalitpur, and Shivapuri Nagarjun National Park. Records of bird seizures were separated from those of other wildlife, and information on species, volumes, seizure locations, dates, and participants involved was extracted.

We also collected information from Nepal Police's Central Bureau of Investigation (CIB), which is responsible for arresting offenders. CIB publishes press releases detailing seizures and including photographic evidence. Further, we cross-checked seizure records with reports from digital newspapers, including *The Kathmandu Post*, *The Gorkhapatra*, *Onlinekhabar.com*, and *MyRepublica.* In several instances, official records contained incomplete information; in such cases, missing details (e.g., species identity, quantities) were supplemented using photographic evidence and descriptions from CIB releases and media reports, where available.

To avoid duplication across sources, records were matched using seizure date, location, species involved, number of individuals, and case description. Events that matched on these key attributes were treated as the same seizure and counted only once. Species identification was based on the most reliable available evidence, including official seizure records and

photographic confirmation from police or media sources. Records lacking sufficient detail for reliable species identification were excluded from species-level analyses.

To examine temporal variation in seizure records, we plotted annual seizure incidents from 2011–2021 and tested for monotonic temporal trends using Spearman's rank correlation. A non-parametric approach was selected because seizure data were counts with a small sample size and did not meet assumptions of normality.

2.2.3. CITES trade data review

We reviewed bird trade data from the CITES Trade Database. This included records from 1975 to 2022, obtained using the following terms: Nepal; importing countries/exporting countries: all; source: all; trade terms: all terms; purpose: Aves (Birds); search by taxon.

We included re-exports or transactions for personal or scientific purposes. This study used the database's comparative tabulation outputs, as net and gross outputs provide an overview of trade involving a specific party or taxon but require additional calculations that may complicate interpretation. When shipment quantities were not explicitly listed, we assumed that the reported volume referred to the total number of shipments, following guidance from the *CITES User Guide* (version 9).

Trade volumes were calculated using exporter-reported data as the primary source. To enhance reliability and address discrepancies, the figures were cross-checked with importer-reported data. Notable inconsistencies included instances in which importing countries reported quantities that were absent from exporter-reported records.

The CITES Trade Database was reviewed to assess the legal trade status of CITES-listed bird species recorded during the market survey and systematic online survey. Species observed in the market and on social media were cross-checked against Nepal's CITES trade records to determine whether corresponding legal international trade records existed. This database was used solely as a legal status reference and was not treated as an independent source of market trade records.

2.2.4. Systematic online survey

The study adopted a systematic survey approach, following the methodology proposed by Roberts et al. (46), to investigate online trade in birds in Nepal. This included both live and parts in trade; hence, identifying appropriate search terms was a critical first step in this process (Table 1). We listed all potential keywords, including terms referring to bird taxa and trade-related terms used to advertise a sale post or an interest in buying. This gave us a list of 16 words, from which we selected 12 keywords based on a pilot survey and consultations with experts in October 2021. These 12 core terms were subsequently expanded to include spelling variants and Nepali-language equivalents, yielding a final list of 42 search terms (Table 1) used in the systematic survey.

In November 2021, we conducted our final survey on Facebook, one of the most widely used social media platforms in Nepal, targeting the wild bird trade. Using the identified search terms, we systematically searched publicly accessible content, including Facebook groups, pages, and posts posted between January 2019 and November 2021. For each relevant post, we documented essential details, including the species involved (where identifiable) and temporal information; we did not collect personal details of the seller and potential buyers. Duplicate posts were identified based on similarities in text, images, and posting details, and were excluded from analysis to ensure accuracy and prevent overestimation.

The lead author performed species identification based on images and text from the posts. Where identification was doubtful, images were cross-checked against standard references (e.g., Birds of Nepal, a bird identification book) and verified by bird experts.

Table 1
Logic grid for traded species and trade terms used for social media monitoring conducted during October 2021, looking for wild birds in trade.

Terms	English (Nepali)	Remarks
Taxa (including products)	Bird, Birds (□□□, □□□□□□)	We only included the search terms indicating the trade of native birds for taxa
	Parrot, Parakeet (□□□□)	
	Owl (□□□□□□, □□□□□□□□□□, □□□□□)	
	Myna (□□□□, □□□□, □□□□, □□□□□□□)	
	Munia (□□□□□□□)	
	Pheasant (□□□□□)	
	Peacock, Peafowl, feathers (□□□□□, □□□□□□)	
	Kalij (□□□□□)	
Trade	Sale, I will sell, I sell (□□□□□□□□, □□□□□□□)	Trade terms include words that denote “offer for sale” in Nepal, and English, and wrong spellings as identified during our pilot surveys
	Sell, I will sell, I sell (□□□□□□□□, □□□□□□□)	
	Available (□□□□□□)	
Location	Nepal (□□□□□), Kathmandu	We only looked for these terms to have an idea of the national-level trade

2.2.5. Spatial mapping of trade and seizure locations

To examine the spatial distribution of bird trade activities, we mapped locations derived from two primary datasets: (i) direct observations from market surveys and (ii) locations of recorded seizure incidents. For the market survey data, geographic coordinates were recorded for each site visited within Kathmandu Valley where bird trade activities were observed. These included locations where live birds, bird parts, or evidence of related trade were documented during field surveys.

For seizure data, location information was obtained from official records, police reports, and associated media sources. Where precise coordinates were not available, locations were approximated based on the reported place names (e.g. market areas, religious sites, or administrative units). All spatial data were compiled and visualised using Geographic Information System (GIS) software (QGIS 3.44.14). Trade locations and seizure sites were plotted as point data to illustrate their spatial distribution. In addition, key features such as major roads and religious sites were overlaid to provide contextual understanding of trade patterns.

3. Results

3.1. Species recorded across datasets

Across all datasets, we recorded 31 unique bird species from six orders and ten families (Supplementary Table 1) in trade. These records were obtained from datasets of different time periods and using different methodologies, i.e., seizure records from 2011 to 2021, a market survey conducted in 2022, and social media observations from 2019 to 2021. Therefore, the pooled species count represents the overall number of species documented rather than a time-matched estimate of trade.

This figure includes globally threatened species like Yellow-breasted bunting *Emberiza aureola* (Critically Endangered), Java Sparrow *Lonchura oryzivora* (Endangered), as well as Black-cheeked lovebird *Agapomis nigrigenis* (Vulnerable). Of these, 15 species are listed under CITES appendices (Appendix I = 1, Appendix II = 12, Appendix III = 2). Amongst these, only two species - Black-cheecked lovebird *Agapornis nigrigenis* (import of 700 live individuals, exotic to Nepal) and the Common hill myna *Gracula religiosa* (export of 12 individuals, native to Nepal), were found in the CITES Trade Database. Notably, members of the family Psittacidae, including parakeets and lovebirds, dominated the trade.

Although interviews inquired about bird origin and trade route, responses were too inconsistent/incomplete to permit systematic reporting.

3.2. Physical Market in Kathmandu Valley

Across the 19 potential sites and 38 visits conducted between 9 and 30 January 2022, we observed 18 bird species in trade around religious sites and trade hubs of Kathmandu. The trade in live birds was more organised through bird shops at religious sites such as Swayambhu and the Bouddha area. The trade was conducted more informally by individual traders through mobile shops in areas such as New Road, Ason, Dallu, and Kshetraapati, sites famous for traditional markets. We found a large number of Indian peafowl *(Pavo cristatus)* feathers sold near religious sites, in particular Bouddha, Pashupatinath, Balaju, Budhanilkantha, and Swayambhu, which are key pilgrimage sites for Hindus and Buddhists (Fig. 3).

3.3. Seizure Records

Between 2011 and 2021, enforcement authorities seized 2,105 live birds, of which only 18 could be identified to species level. Among these, 11 were native, and 7 were exotic. Seizures occurred at 24 locations in the Kathmandu Valley, predominantly around religious sites and close to the valley's entry and exit points (Fig. 4).

Annual seizure records varied across the study period. The highest seizure was in 2014, and the lowest seizure was in 2020.

3.4. Trade on Facebook

We identified 50 posts involving seven wild bird species marketed for sale on facebook platform. These included 19 posts from nine accounts: 18 posts from nine public groups and 13 posts from seven pages. Of the 23 posts with a trade location mentioned, Kathmandu (n = 9) was the most frequent, followed by Biratnagar (n = 7). We also recorded posts referencing foreign locations, such as Dubai (n = 2) and Saudi Arabia (n = 1). These two locations indicated that the seller or buyer was based in Dubai and Saudi Arabia.

3.5. People involved in the bird trade

The demographic analysis of individuals involved in the illegal bird trade in Nepal highlights significant patterns in age, gender, and ethnicity. Among marketplace traders, 52% are aged 20–39, with similar representation (67%) observed among seizure arrestees, while younger (< 20) and older (> 50) individuals are minimally involved. Gender disparities are evident: males comprise 66% of traders and 93% of arrestees, while females account for 33% of traders. Indigenous groups are dominant, constituting 48% of traders and 32% of arrestees, followed by Brahmin/Chhetri and Muslim groups, whereas Madhesi and Dalit individuals show less involvement (Table 2). Notably, 8% of arrestees' ages and 25% of their ethnicities are unreported, indicating potential data gaps in seizure records.

Table 2
Demographics of arrestees and bird traders in physical marketplaces

Background	Marketplace traders (%)	Seizure arrestees (%)
Age category		
< 20	3 (11%)	8 (7%)
20–29	7 (26%)	47 (43%)
30–39	7 (26%)	27 (24%)
40–49	6 (22%)	12 (11%)
> 50	3 (11%)	6 (5%)
Not mentioned	1 (3%)	9 (8%)
Gender		
Male	18 (66%)	102 (93%)
Female	9 (33%)	5 (4%)
Not mentioned	-	2 (1%)
Ethnicity		
Brahmin/Chhetri	5 (18%)	26 (24%)
Dalit	1 (3%)	1 (0.9%)
Indigenous	13 (48%)	35 (32%)
Madhesi	5 (18%)	1 (0.9%)
Muslim	2 (7%)	19 (17%)
Not mentioned	1 (3%)	27 (25%)

3.6. Legal permits and awareness

The majority of the bird traders are found to be not aware of the legal requirements for bird trade. Only 22% (n = 6), comprising bird shop owners, acknowledged the need for legal permission, as they operate from fixed locations. The majority (59%, n = 16), primarily mobile traders, believed no permission was necessary, citing the open sale of birds by shops as justification. A small percentage of vendors of Indian Peafowl feathers (7%, n = 2) were unsure about the legal provisions, while 11% (n = 3) refused to answer. These results show substantial knowledge gaps about legal provisions as well as variations in perceptions among trader types. Among respondents who said that permission was required, common explanations included Permanent Account Number (PAN) registration, a trade permit from the Kathmandu Metropolitan, and the claim that only home-bred birds were being sold.

4. Discussion

This study provides multi-source information on bird trade in Kathmandu Valley, integrating physical market surveys, interviews, seizure records, Facebook monitoring, and the CITES Trade database. Our findings are consistent with global wild bird trade posing a threat to biodiversity in Nepal, occurring alongside growing digital markets, enforcement gaps, and cultural demand. However, this study's design is based on trade observation rather than population monitoring. We documented 31 bird species in trade, dominated by parakeets, including the critically endangered yellow-breasted bunting. We identified religious sites such as Bouddha and Swayabhu as primary locations for the bird trade. Nepal's status as a

source and transit location illustrates the need to strengthen legal frameworks, enhance surveillance, and curb trafficking to safeguard its bird diversity.

4.1. Bird species in illegal trade

During our study, we documented 31 bird species from 6 orders and 10 families in trade, aligning with the alarming global trend of illegal wildlife trade (22, 44, 47, 48). Psittacidae species were the most dominant in the trade, particularly the Alexandrine parakeet, *Psittacula eupatria* (CITES Appendix II), and the Rose-ringed parakeet, *Psittacula krameri*, which collectively accounted for over 40% of traded individuals. This preference for parakeets in the trade mirrors the international pattern, where parrots and parakeets face over-exploitation for the pet trade, resulting in population declines (21, 24, 49). The open trade in globally threatened species such as Black-cheeked lovebird *Agapornis nigrigenis* and Yellow-breasted bunting *Emberiza aureola* is a serious concern that aligns with observations in Southeast Asia. Shepherd et al. (50) and Leupen and Shepherd (51) found that the globally threatened Straw-headed bulbul, *Pycnonotus zeylanicus, and* the Black-winged myna, *Acridotheres melanopterus*, have been gradually driven to extinction by illegal trade. Phassaraudomsak and Krishnasamy (48) found 50% of traded bird species were legally protected in Thailand. Dingle et al. (52) recorded trade of six globally threatened species in Hong Kong. Such findings have been documented from India as well as Brazil (22, 47), revealing a global conservation challenge.

Native species such as Alexandrine and Rose-ringed Parakeets are more likely to be wild-caught and therefore represent a more direct pressure on wild populations. In contrast, non-native species such as the Black-cheeked Lovebird are widely bred in captivity internationally, suggesting that the 700 individuals recorded in CITES import data more likely originated from captive-breeding operations than from wild populations in its native range. Notably, Nepal's recorded species richness and social-media trade volume (31 species; 50 posts) are considerably smaller than in Jakarta (206 species; Chng et al. (44) or Hong Kong (210 species; Dingle et al. (52), which may indicate Nepal's exotic pet trade is less entrenched than regional comparators, a potential opportunity for preemptive intervention before the trade becomes more established.

While this study did not directly document transboundary trafficking routes, the gap between CITES-listed species recorded in trade (15) and those appearing in the CITES Trade Database (2) points to an unresolved question about how these species enter trade. This may indicate gaps in enforcement and/or limited prioritisation of the issue, which is consistent with the continued occurrence of illegal activities. An alternative explanation is that some individuals were imported before the species' CITES listing or Nepal's accession to the Convention, in which case no CITES record would be expected regardless of legality. As a cautionary parallel, enforcement failures have contributed to Bangladesh's suspension from CITES (53), underscoring the stakes of addressing similar gaps in Nepal. However, this study cannot establish that the same mechanism applies here. While the global population collapse of the Yellow-breasted Bunting has been attributed primarily to trapping for food/consumption (13), the individuals recorded in this study were observed in live trade; whether this reflects the same threat pathway or a distinct driver cannot be determined from this study.

4.2. Trade activities concentrated around religious sites

We identified major religious sites, such as the Bouddha and Swayabhu areas, which are sacred to Buddhists, as trade hubs in Kathmandu. The concentration of trade activities in these locations may be associated with their religious significance, in which the ceremonial release of birds is considered meritorious. Shiu and Stokes (54) noted that “the Bodhisattvas should practice the act of releasing animals due to the mind of compassion”. It might be the reason that similar findings of the merit of bird release are evidenced from other parts of Buddhist-dominated South and Southeast Asian countries - China, Thailand, Cambodia and Taiwan (54, 55).

To combat this ongoing trade in the religious area of Kathmandu, a comprehensive approach that includes enhanced enforcement at known locations should be a critical step. Further undercover operations and regular patrols during peak trade periods, such as Lhoshar and Buddha Purnima (Buddhists’ sacred days), should be included. However, active enforcement and behaviour change in public are often difficult for such deeply entrenched cultural practices (56). Along with

enhanced enforcement, culturally sensitive public awareness should be raised. Ayling (57) reported that religious groups issued statements condemning the illicit wildlife trade, thereby influencing demand for wildlife products. Such awareness practices by religious institutions are also observed in Thailand (58). Public awareness campaigns are effective in combating the illegal wildlife trade by shifting public attitudes and reducing demand (59).

We acknowledge that the relatively small sample size of interviewed traders and the opportunistic sampling approach may introduce bias; however, triangulation with multiple data sources (market observations, seizure records, and online surveys) strengthens the robustness of the findings. Given the descriptive and cross-sectional nature of the study, the observed relationships between regulatory uncertainty, trader awareness, and bird trade should not be interpreted as causal.

Beyond biodiversity impacts, bird trade, particularly through the release of birds, carries additional risks, including disease transmission and the establishment of invasive species, alongside animal welfare concerns and potential zoonotic risks to traders, buyers, and domestic animals.

4.3. Burgeoning illegal trade over digital platforms

Our study documented 50 posts in a social media survey involving seven wild bird species in Nepal, including CITES Appendix II-listed taxa such as the Alexandrine parakeet *Palaeornis eupatria* and the Red-breasted parakeet *Psittacula alexandri*, alongside nationally vulnerable and near-threatened species. These results are consistent with global trends in which digital platforms have facilitated illegal wildlife trade. For example, Krishnamany and Stoner (60) found 35 birds, mostly CITES-listed, on Malaysian Facebook groups. Similarly, Sung et al. (14) recorded 441 CITES-listed turtle species traded via social media. The use of digital media has also been documented by Martin et al. (49), who found that 70% of African grey parrot (*Psittacus Erithacus)* posts violated national or international legislation. The dominance of parakeets and mynas in Nepal's online trade reflects historical pet preferences, resonating with patterns in Thailand and Indonesia. Phassaraudomask and Krishnasamy (48) reported Critically Endangered Helmeted hornbills *Rhinoplax vigil* on Thai Facebook, while Nijman et al. (9) found 599 raptors traded via Indonesian social media. More broadly, a TRAFFIC assessment of the live animal trade in Kazakhstan, Kyrgyzstan and Uzbekistan found that online platforms accounted for four-fifths of all recorded trade offers, including CITES-listed birds, indicating that the shift toward digital marketplaces extends well beyond Southeast Asia (61).

Legal reforms, increased enforcement, along with social media policy reform, may help to reduce the misuse of social media for illegal trafficking. For example, Davies et al. (62) found a decline in posts about African Grey Parrots after the species was uplisted in CITES Appendix I, enhanced law enforcement, and the implementation of new policies by social media platforms. A recent platform-scale analysis of wildlife advertisements on Facebook similarly concluded that the platform functions as central public infrastructure through which online wildlife trafficking is concentrated, discovered and scaled, with most listings encountered passively through groups and algorithmic recommendations rather than active searching, and called for enforceable platform duties and multilingual content moderation (63). Nepal can learn from this evidence and strengthen collaboration with tech firms to flag keywords in the Nepali language (e.g., "□□□□", "□□□", "□□□□□", "□□□□") to curb digital trafficking. Data collection took place between 2011 and 2022; given the rapid evolution of digital wildlife trade platforms in particular, current trade patterns, especially on social media, may differ from those reported here.

4.4. Legal ambiguities confuse traders and officials

Our study reveals legal ambiguities in Nepal's wildlife trade policies that may complicate compliance and are consistent with ongoing global trends (64). A survey of 27 traders found 59% believed no permits were required for bird trade, citing the open sale of birds in shops as justification. Only 22% (primarily fixed-location shop owners) acknowledged legal requirements, often misinterpreting municipal tax registrations as trade licenses. This confusion may be related to inconsistencies and the lack of species-level specificity in existing policies. For example, Nepal's bird farming policy (Panchi Palan Niti 2068) listed nine bird species (Chickens, Ducks, Quails, Guineafowls, Turkey, Pigeons, Ostriches, Kalij, and Partridge) as domestic birds, permitting their farming and trade, but does not consistently identify the taxa using species-level scientific names. For instance, Kalij and Partridge normally refer to *Lophura leucomelanos* (considered wild) and *Alectoris chukar* (nationally near-

threatened and considered wild) in Nepal. Moreover, the policy fails to specify birds at the species level, leaving it unclear which species it refers to. For instance, Kalij and Partridge are commonly used for *Lophura leucomelanos* and *Alectoris chukar*, respectively, while the generic term “Quail” does not clearly distinguish among potentially different taxa. This is particularly important where a common category may overlap with a conservation-priority wild species, such as the nationally Critically Endangered Asian Blue Quail, *Synoicus chinensis*. Such confusion remains prevalent in the recently amended (Fifth) National Parks and Wildlife Conservation Rule 1974 and the Standards related to Commercial Farming, Breeding and Use of Wild Animals, 2023. The act lists at least 12 bird species, and the guidelines list at least 10 that can be legally farmed and traded. However, where permitted bird categories are not clearly linked to scientific species names, the boundary between domestic birds, native wild birds and other taxa may remain difficult to interpret consistently.

The distinction between legal wildlife regulation and general administrative documentation is also important. Traders reported using municipal tax registration documents as evidence that their bird businesses were legally authorised. Such documents may demonstrate a business's registration or taxation but should not necessarily be interpreted as wildlife trade permits. Clearer specification of the respective responsibilities of local governments and wildlife authorities could therefore reduce uncertainty among traders and enforcement agencies.

The National Parks and Wildlife Conservation Act, 1973, and the Control of International Trade of Endangered Wild Fauna and Flora Act, 2017, in Nepal have strict provisions imposing penalties of up to a 1 million Nepalese rupee fine, 15 years' imprisonment, or both. However, the treatment of exotic and non-CITES birds represents another area requiring clarification in Nepal. Our review found that existing wildlife legislation does not clearly specify the regulatory treatment of non-CITES exotic birds, such as cockatiels and budgerigars, creating uncertainty about whether particular species require authorisation, may be freely traded, or should be subject to specific documentation requirements. Rather than assuming that such uncertainty directly facilitates illegal trade, it may provide scope for inconsistent interpretation by traders and enforcement authorities.

Despite decades of documentation of illegal bird trade (65)(42), the issue has not yet been prioritised in Nepal. Nepal needs urgent amendments to the legislation to ensure clarity and enforceability. A priority could be the mandatory use of species-level taxonomy in all relevant laws: Panchi Palan Niti, 2068; National Parks and Wildlife Conservation Act, 1973; National Parks and Wildlife Conservation Act, 1974; and Standards related to commercial farming, breeding, and use of wild animals, 2023. Additionally, explicit provision for exotic and non-CITES species should be included in existing legislation, or dedicated legislation should be enacted to regulate non-CITES-cum-exotic species. Further, the extension of the policy is equally imperative for a common understanding of the legal provision and coordination among the regulatory agencies.

These findings suggest several practical legal reforms. First, bird species listed as permitted for farming, breeding or trade should be identified using species-level scientific names together with locally used common names. Second, separate schedules should clearly distinguish domestic poultry, native wild birds, exotic species and CITES-listed species. Third, the legislation should clearly specify which authority is responsible for issuing wildlife-trade permits and distinguish such permits from municipal business or tax registration. Fourth, the regulatory status of non-CITES exotic birds should be explicitly defined to provide clear guidance for traders and enforcement agencies. Finally, relevant provisions should be harmonised across the *Panchi Palan Niti*, National Parks and Wildlife Conservation Act and Rules, and the 2023 Standards to ensure that the same species are not treated differently across regulatory instruments.

Our research highlights that the illegal bird trade is prevalent in Nepal involving even globally threatened species openly traded. Digital platforms are evolving into new platforms for illicit trafficking, while religious sites like Bouddha and Swayambhu remain prominent hotspots. Most importantly, legal ambiguities and limited prioritisation may pose ongoing challenges to efforts to regulate illicit trade. The lack of species-level specificity and the absence of provisions concerning non-CITES exotic birds may contribute to uncertainty in enforcement and regulation. Urgently, Nepal needs to resolve legal ambiguities, bolster targeted enforcement in physical markets and on digital platforms, and conduct culturally sensitive public awareness campaigns.

Declarations

Data availability: The data are not publicly available to protect the privacy of research participants. However, the coded datasets can be shared upon request.

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Ethical declarations

Ethics approval and consent to participate: The research was conducted with approval from the Government of Nepal and the Social Welfare Council, and in accordance with ethical protocols approved by the Safeguard Policy and Ethics Committee of Greenhood Nepal. Informed verbal consent was obtained from participants. They were assured of anonymity and of the voluntary nature of participation, with no legal consequences for involvement in the study.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Clinical trial number

Not applicable.

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Figures



Figure 1

Map of Kathmandu Valley, which covers Kathmandu, Bhaktapur and Lalitpur districts of Nepal



a b c

Figure 2

Evidence of bird trade observed during market survey a) Rose-ringed parakeet *Psittacula krameri*on trade in Kathmandu,

b) Yellow-breasted bunting *Emberiza aureola*, a critically endangered species found on trade in the Swayambhu area; c) Huge sale of Indian Peafowl *Pavo cristatus* feathers at a religious site

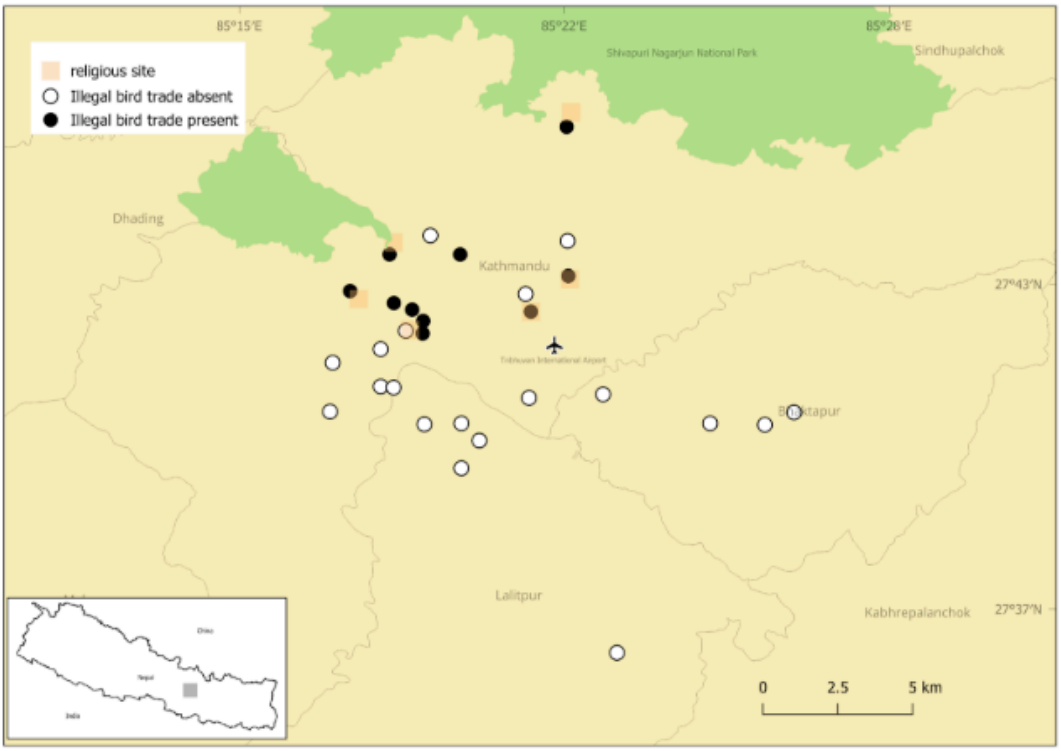


Figure 3

Map showing bird trade sites in Kathmandu Valley around religious sites observed during 9 to 30 January 2022. (These maps are intended to represent observed distributions of trade rather than statistically defined hotspots. Areas with a higher concentration of points are interpreted as indicative of higher trade activity. Still, results should be considered in light of variation in sampling effort and reporting across datasets.)

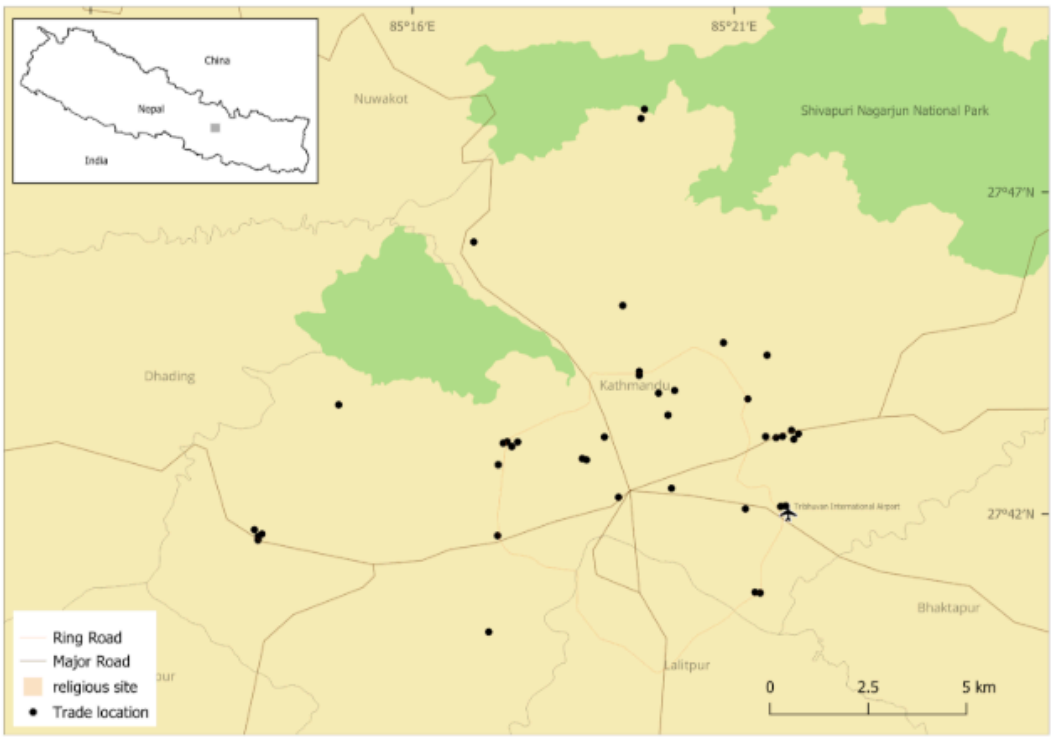


Figure 4

Map showing recorded bird seizure locations in Kathmandu Valley from 2011 to 2021 (Points represent observed locations and are not the output of a statistical hotspot analysis; concentrations should be interpreted in light of variation in sampling effort and reporting across sources.)

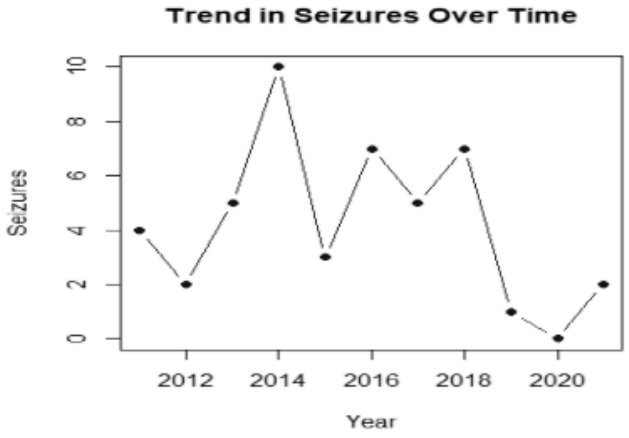


Figure 5

Trend in annual seizure frequency from 2011 to 2021, showing fluctuations in seizure counts over time with no statistically significant overall temporal trend (Spearman's ρ = −0.362, p = 0.275).

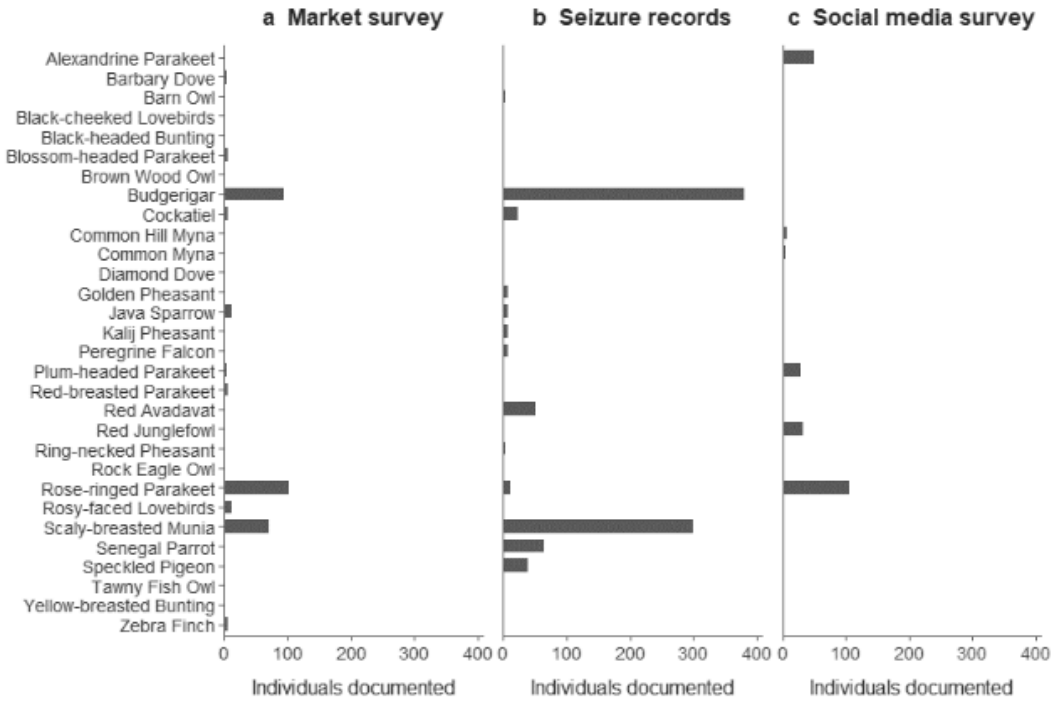


Figure 6

Bird species recorded in our survey in the physical market during 9 to 30 January 2022, on social media during November 2021, and in official seizure records in Kathmandu Valley from 2011 to 2021 (we have excluded the Indian peafowl, since we only documented feather trade during market survey and could not quantify its individual)

Note: datasets were collected over different, non-overlapping time periods and are shown together for descriptive comparison only, not as a time-matched trend.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- SupplementaryMaterial1.docx
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