

Insights from the media into the bird trade in India: an analysis of reported seizures

SHARDA KALRA, ALISA DAVIES, ROWAN O. MARTIN and ASHA POONIA

Abstract India has an extensive bird trade that provides income and livelihoods for many people but involves considerable unregulated and illegal activity, threatening both native and exotic species and posing potential health risks to people and wildlife. Action to curb illegal trade is vital, but there is currently a lack of information on trade routes and the species involved to inform the development of strategies to address such trade. We therefore examined media reports of bird trade seizures published during 2010–2020 as a cost-effective approach to gaining insights into the composition and structure of the bird trade in India. We collected 182 media reports referring to 109 seizure events by searching for keywords on popular search engines and Indian newspaper websites. We found that 25,850 birds were seized, most frequently members of the family Psittacidae. Of the 58 species identified, 18 were native and 40 non-native to India. The greatest numbers of birds were seized in Uttar Pradesh. Analyses of trade networks indicate that Uttar Pradesh is an important trade hotspot particularly for native species and has strong transnational connections with neighbouring Nepal. We identified West Bengal as an important trade hotspot, particularly for non-native species, probably because of its extensive land borders with neighbouring countries, including Bangladesh. Our study highlights priority areas for interventions as well as key knowledge gaps that need to be addressed to facilitate the development of strategies to manage illegal, unsustainable and otherwise harmful trading of birds.

Keywords Birds, caged-bird trade, India, media-reported seizures, South Asia, wildlife confiscations, wildlife trade, wildlife trafficking

The supplementary material for this article is available at doi.org/10.1017/S0030605322001594

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Received 16 July 2022. Revision requested 28 September 2022.

Accepted 20 December 2022. First published online 11 September 2023.

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Oryx, 2024, 58(1), 69–77 © The Author(s), 2023. Published by Cambridge University Press on behalf of Fauna & Flora International doi:10.1017/S0030605322001594

<https://doi.org/10.1017/S0030605322001594> Published online by Cambridge University Press

Introduction

The wildlife trade is a vast and complex industry affecting many taxonomic groups and providing livelihoods for millions of people. Its nature ranges from local commerce to multi-billion-dollar legal industries and extensive criminal networks (Wilson-Wilde, 2010; Cardoso et al., 2021). Local communities can participate in both legal and illegal exploitation, acting as mediators to wider markets for both subsistence and economic development (Cooney et al., 2017). Legal complexities, new technologies, globalization and increased access to the internet have created new opportunities to establish businesses and have led to increased levels of online wildlife trade. There has been a particular expansion of wildlife trade on social media platforms, where the ownership of wildlife and wildlife products is promoted and trade is facilitated (Hinsley et al., 2016; Martin et al., 2018).

Birds are popular in the exotic pet trade (Bush et al., 2014) and are in high demand in the domestic and international pet trade. This has led to an overexploitation of wild populations, driving global loss of biodiversity (Alves et al., 2013; Khelifa et al., 2017). The bird trade can also lead to the introduction of invasive species (Cardador et al., 2019) and increase the risk of pathogen transmission (Swift et al., 2007). Outbreaks of avian diseases can have major consequences for agriculture and human health, and these risks have led many countries to prohibit or severely curtail imports of wild birds. In 2005, EU countries ended the importation of wild-sourced birds partly in response to a major outbreak of highly pathogenic avian influenza. Because of a lack of biosecurity measures, local communities with close connections to the animal trade are at particular risk (EFSA, 2006).

India has emerged as a region of concern regarding illegal domestic and international wildlife trade in many taxa, including birds (Badola & Gautam, 2022), and the volume of such trade appears to be increasing (Lowen, 2021). As the country with the second largest human population but with a low mean income per capita, the incentives to engage in illegal wildlife trade as an economic activity are high. Additionally, rising incomes in urban areas have increased demand, with exotic pet ownership considered by some consumers to promote social status (Lowen, 2021). According to the CITES trade database, India has reported the import of only 3,859 CITES-listed birds in the past 45 years (CITES, 2021) despite a thriving internal trade in exotic species (Lowen, 2021), suggesting that illegal trade in exotic species is extensive. Although there have been

some market surveys of the bird trade in India (Ahmed, 1997; Singh et al., 2011; Bhupathy et al., 2013), these have been limited in geographical scope and there is little information on national trade routes.

Understanding the characteristics of legal and illegal wildlife trade is vital for developing effective strategies to prevent associated harm. However, obtaining data on the scale and scope of such trade, species composition and trade routes can be problematic. Although the CITES trade database (CITES, 2021) provides a valuable and accessible source of data on international wildlife trade, it is limited to species listed in the CITES appendices (< 15% of bird species) and largely does not capture illegal trade. Other methods such as market surveys can provide valuable insights but are time and resource intensive and more likely to be limited to a small region (Indraswari et al., 2020). Information on seizures can provide useful data on illegal trade (Rosen & Smith, 2010) but also on broader legal trade, as not all seizures involve trafficking but could be the result of other rule violations or administrative errors (Challender et al., 2022). Several recent studies have used reports of wildlife law enforcement events and seizures in public news media to obtain systematic information on wildlife trade networks on a national and international scale (Hansen et al., 2012; Indraswari et al., 2020). Although such information must be interpreted with care because of biases in enforcement effort and reporting (Challender et al., 2022), it can nevertheless provide a rapid, detailed and broad picture of recent trade that would otherwise be difficult to obtain.

In this study, we collected and analysed information gathered from media reports of seizures of birds in India to gain insights into the taxonomic composition, key trade routes and regional hotspots of this trade. We use the results to make recommendations for further research and actions to help curb illegal and unsustainable trade in birds.

The legal context

The ownership and trade of wildlife in India is regulated under national and international legislation (Poonia et al., 2022). Since 1972 the killing, trading, exporting and keeping of Indian native birds, covering c. 1,210 species, has been illegal under the Indian Wild Life (Protection) Act, 1972, with the exception of the house crow *Corvus splendens* under the category Vermin, the naturally shed tail feathers of peafowl *Pavocristatus* and trade for research and by zoos under permission from the Ministry of Environment (Ahmed, 2018). In 1976, India became a Party to CITES, the main international treaty to monitor and regulate international wildlife trade. Exotic birds cannot be imported without a license issued by the Director General of Foreign Trade and a No Objection Certificate from the Chief Wildlife Warden of the relevant State

Government confirming that the import complies with CITES and EXIM (India's Export-Import Policy) policy (Ahmed, 2018) and following the quarantine protocols issued by the Ministry of Fisheries, Animal Husbandry and Dairying. In August 2022, an amendment to the Wild Life (Protection) Act, 1972 implemented CITES obligations in national legislation; species listed in the CITES Appendices were placed on Schedule IV, meaning that ownership and trade of them is now regulated. However, before this there was no provision in domestic legislation in India to regulate the domestic breeding, ownership or trade of exotic species once imported.

Methods

Data collection

We gathered reports covering an 11-year period: January 2010–December 2020. We collected reports relating to bird confiscation using online sources, *Google News* and newspaper websites of *The Hindu*, *The Indian Express* and *The Times of India*, which are popular and the most read English-language newspapers in India, and *Dainik Jagran* and *Dainik Bhaskar* representing Hindi-language newspapers. We selected the following keywords for our search: 'bird confiscation in India', 'bird seizure in India', 'bird smuggling in India', 'bird trafficking in India' and 'bird trade in India' in English and 'Pakshi Jabti' and 'Pakshi Taskari' in Hindi. We also extracted information regarding seizures in reports produced by the NGOs TRAFFIC, WWF and IUCN.

We analysed media reports manually to extract data. We did not consider data related to wildlife other than birds or to the international bird trade not involving India. For each report we recorded the numbers of each species seized based on the report text and supported by available imagery. We recorded separately species that were mentioned in trade but were not part of the seizure (Supplementary Table 1), but did not include these in our analyses. We used Avibase (2022) and eBird (2022) to support identification but followed the *Handbook of Birds of the World* (BirdLife International, 2022) for taxonomic classification. For each species we recorded the conservation status according to the IUCN Red List and determined whether species were native to India (i.e. the global distribution includes India) or exotic by referring to BirdLife International (2022). If the number of birds was not given but they were referred to in the singular, we listed their number as one. If they were referred to in the plural, we assumed that there were 10 for the purposes of further quantitative analyses (following Indraswari et al., 2020). If no information on the species was included in the report, we recorded the species as 'unknown'. In 15 reports birds were listed by a non-specific name (i.e. 'parrots'), but we used the images to identify the species and approximate

number. We did not find any cases in which birds were incorrectly identified.

We recorded the location (city/town and state) where the seizure was made and the origin, destination and any transit locations for the shipment if mentioned. A single route sometimes contained multiple intermediary nodes (locations through which trade passed), with the most being five nodes.

To avoid duplication, we cross-referenced dates, locations and the species involved against other media reports. We combined duplicate reports for a single seizure incident in subsequent data analysis. If there was a mismatch in the number of birds reported for the same seizure, we used the higher number.

Trade network analysis and mapping

To visualize geographical variation in the numbers of seized birds and to identify hotspot regions, we created a heatmap showing the number of birds seized in each state, using the packages *ggplot2* (Wickham, 2016) and *rgdal* (Bivand et al., 2021) in *R 4.3.0* (R Core Team, 2023), with map files downloaded from Geographical Analysis (2022).

We described trade routes by adapting approaches used in similar studies of wildlife trade networks (Indraswari et al., 2020; Sánchez-Mercado et al., 2020). India is divided into 36 administrative regions comprising 28 states and 8 union territories. We treated each state, union territory and international country as a 'node' in the network. We created separate directed networks for native and exotic species. For each network we calculated the in-degree centrality (the number of connections coming in from other nodes), the out-degree centrality (the number of connections going out to other nodes), and the betweenness centrality (the number of shortest paths in the network that must pass through a node). We used these values to identify major sources (high out-degree centrality), destinations (high in-degree centrality) and transit points (high betweenness centrality). We created network diagrams using the *R* package *igraph* (Csardi & Nepusz, 2006).

Results

We recorded 182 media reports describing 109 bird seizures during 2010–2020 (Fig. 1). Of these reports, 167 were from online news and media reports and 15 were from NGO reports. In eight reports the number of birds was not mentioned, and these were assumed to involve one or 10 birds depending on whether birds were mentioned in the singular or plural.

Species analysis

We recorded an estimated total of 25,850 birds being traded, of which 1,518 were exotic, 4,763 were native, 12,656 were

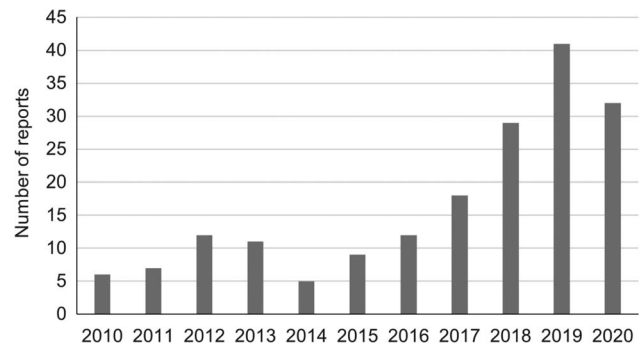


FIG. 1. Number of Indian media reports of bird seizures during January 2010–December 2020.

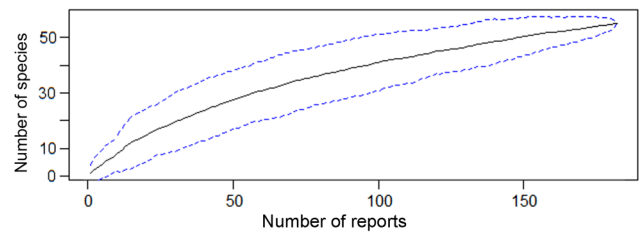


FIG. 2. The cumulative number of bird species (of a total of 58) identified in media reports of seizures during January 2010–December 2020, with 95% confidence intervals (dashed lines).

of unknown origin and 6,913 were from mixed reports, meaning that the number of birds from each species was not explicitly given. Family could not be identified for 77 birds. We recorded 58 species from 20 families in seizures (Supplementary Table 2), although based on the species accumulation curve this number would probably increase further with the addition of more seizures (Fig. 2). Quantity could be identified for 44 species (Table 1), and 28 species were named in mixed groups (Supplementary Table 3). We also recorded 172 juvenile birds (of which 49 were of unknown species) and 131 birds were reportedly found dead. The most traded family was Psittacidae, accounting for 16,928 birds (66% of the total; Table 1), of which 12,374 were of unknown species and origin, 1,375 were exotic and 3,179 were native.

The IUCN Red List conservation status of most of the species is Least Concern (45 species, 77% of the total), followed by Endangered (5, 9%), Near Threatened (4, 7%) and Vulnerable (4, 7%). Amongst these, six species are listed in CITES Appendix I, 33 species in CITES Appendix II and one species in CITES Appendix III.

The highest number of birds was confiscated in Uttar Pradesh (14,000, 54%), followed by West Bengal (4,850, 19%), Maharashtra (1,867, 7%) and Madhya Pradesh (1,601, 6%; Fig. 3).

Regional trade networks

In the trade network of native species, we identified 25 nodes (states, union territories and countries) compared to only 17

TABLE 1 The number of birds reported in Indian media reports as being seized by the authorities during January 2010–December 2020, by family. The total number of birds reported was 25,850.

| Family | Number of species identified | Number of birds seized | | |
|---------------------------|------------------------------|------------------------|-----------------|--------|
| | | Species known | Species unknown | Total |
| Psittacidae | 21 | 3,304 | 13,624 | 16,928 |
| Estrildidae | 3 | 949 | 0 | 949 |
| Sturnidae | 2 | 246 | 0 | 246 |
| Phasianidae | 4 | 210 | 0 | 210 |
| Columbidae | 1 | 2 | 205 | 207 |
| Ardeidae | 1 | 180 | 0 | 180 |
| Cacatuidae | 4 | 49 | 21 | 70 |
| Anatidae | 2 | 25 | 0 | 25 |
| Cuculidae | 1 | 10 | 0 | 10 |
| Strigidae | 0 | 10 | 0 | 10 |
| Falconidae | 1 | 8 | 0 | 8 |
| Casuariidae | 1 | 1 | 4 | 5 |
| Phoenicopteridae | 0 | 0 | 4 | 4 |
| Struthionidae | 1 | 2 | 0 | 2 |
| Paradisaeidae | 0 | 0 | 2 | 2 |
| Accipitridae | 2 | 3 | 0 | 3 |
| Bucerotidae | 1 | 1 | 0 | 1 |
| Mixed report ¹ | 28 | 6,913 | 0 | 6,913 |
| Unknown | 0 | 0 | 77 | 77 |

¹The number of birds of each species/family was not identified in the report.

nodes in the network for exotic species. Ten nodes were common to both networks (Fig. 4).

West Bengal was the most important hotspot in both native and exotic bird trade networks, acting as a major source

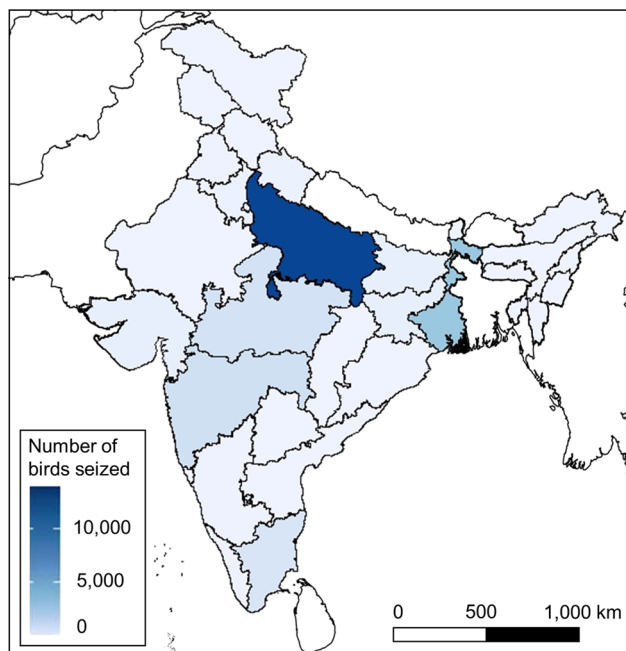


FIG. 3. Heat map of the number of birds seized per state during January 2010–December 2020. The map of India is adapted from Geographical Analysis (2022).

and destination, with high in-degree centrality and out-degree centrality values (Table 2). In both networks it acted as a major gateway, with the highest betweenness centrality value (native = 65.5, exotic = 31.0), connecting to southern states such as Karnataka and Tamil Nadu and internationally as an importer from Bangladesh and Myanmar. Uttar Pradesh was the second most important hotspot in both networks, acting as the largest source of native birds (out-degree centrality = 6), as an important destination (in-degree centrality = 6) for native birds from neighbouring states such as Rajasthan and Bihar and as a transit point (betweenness centrality = 10) for exotic trade from Nepal.

Other key states included Tamil Nadu as a transit location for trade in native birds (betweenness centrality = 13) and as a destination for exotic birds (in-degree centrality = 4), and Bihar, Madhya Pradesh and Delhi as transit points in the native trade network, all with high betweenness centrality values. Ten countries were involved with bird trade with India, of which Nepal was the most important transit point (betweenness centrality = 24) for trade in native birds to China and Viet Nam, and with Bangladesh and Myanmar acting as the main exporters of exotic birds to India.

Markets as major hubs for illegal trade in India

Media reports highlighted numerous major bird markets, including weekly pet markets in Chennai (Tamil Nadu),

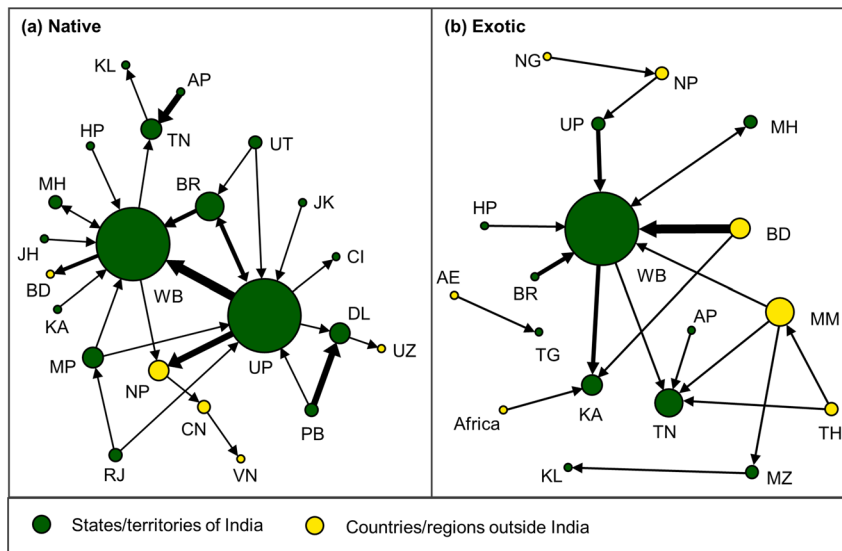


FIG. 4. Network diagrams of bird trade routes in and around India based on media-reported seizures during January 2010–December 2020 of (a) native and (b) exotic species. Arrow width is proportional to the number of seizures in which the connection was mentioned. Circle size is proportional to the total centrality degree (in-degree centrality + out-degree centrality) of the node. Country, region, state and territory abbreviations are provided in Table 2.

Crawford Market in Mumbai (Maharashtra), Russell Market in Bangalore (Karnataka), Jama Masjid market and Chakla area in Delhi, Gallif street market in Kolkata (West Bengal), Mulki Bazaar and Mehboob Chowk bird market in Hyderabad (Telangana), Mishrikar toll market in Patna (Bihar), Bahelia Toil market in Varanasi (Uttar Pradesh) and Nakhas market in Lucknow (Uttar Pradesh).

Discussion

Despite concerns about the growing scale of bird trade in India, there is little information about the characteristics of this trade. Our analysis of media-reported seizures revealed a high volume of bird trade across India, with links to regional and global trade. We identified a broad taxonomic diversity of native and exotic species across a range of bird families, including numerous species threatened by overexploitation. Increases in the number of media-reported seizures during 2010–2020 could be attributable in part to greater enforcement efforts or media attention, but they also reflect patterns reported elsewhere of the growing popularity of the exotic pet trade (Lowen, 2021). Network analysis revealed extensive trade networks crossing multiple international borders, with a small number of highly connected hubs, notably West Bengal and Uttar Pradesh. This could indicate the presence of internationally organized, syndicated trade networks that could be targeted for enforcement action.

Species in trade and implications for conservation, animal welfare and biosecurity

The species accumulation curve and existing information on bird ownership in India suggest that the 25,850 birds of 58 species identified in the media-reported seizures are only a

small fraction of the birds in legal and illegal trade during 2010–2020. Trade in many bird species is permitted or weakly regulated and so will not appear in seizures, and a large proportion of illegal trade is probably not included in our sample because of the challenges of detecting and intercepting illegal trade and because the media might not report all seizures (Paudel et al., 2022).

Parrots (Psittacidae) were the most frequently reported bird family in seizures of exotic and native species, accounting for 65% of all birds seized. It is possible that this group is overrepresented in our sample because parrots are charismatic and recognizable and therefore attract greater enforcement and media attention (Paudel et al., 2022). However, this finding matches international trends in which parrots have been reported to be the most commonly traded avian family (Bush et al., 2014). Some identified species are frequently bred in captivity, such as lovebirds *Agapornis* spp., for which trade may pose little direct threat to wild populations. However, the high popularity of the trade of common and non-threatened bird species can still stimulate unsustainable demand for more threatened species. Research into emerging parrot markets suggests that the high visibility of parrot keeping increases demand through promoting and normalizing this activity, particularly for larger and rarer species (Jain et al., 2021). A number of parrot species that were recorded in seizures are listed in CITES Appendix I and are threatened with extinction by overexploitation, including the African grey parrot *Psittacus erithacus*, hyacinth macaw *Anodorhynchus hyacinthinus* and red-and-blue lory *Eos histrio*. We recorded two native parrot species categorized as Near Threatened on the IUCN Red List: the red-breasted parakeet *Psittacula alexandri* and the alexandrine parakeet *Palaeornis eupatria*, the latter being the third most frequently recorded parrot species. Both species have wide distributions outside India but have undergone localized declines

TABLE 2 Centrality values of network nodes for exotic and native bird species trade networks in India and neighbouring countries (Fig. 4). The highest centrality values for Indian states/territories and international countries/regions are highlighted with an asterisk (*).

| Node | Native | | | Exotic | | |
|--|------------------|------------------|-----------------|------------------|------------------|-----------------|
| | ODC ¹ | IDC ² | BC ³ | ODC ¹ | IDC ² | BC ³ |
| Indian states & territories | | | | | | |
| Andhra Pradesh (AP) | 1 | 0 | 0 | 1 | 0 | 0 |
| Bihar (BR) | 2 | 2 | 14 | | | |
| Chhattisgarh (CI) | 0 | 1 | 0 | | | |
| Delhi (DL) | 1 | 2 | 7 | | | |
| Himachal Pradesh (HP) | 1 | 0 | 0 | 1 | 0 | 0 |
| Jharkhand (JH) | 1 | 0 | 0 | | | |
| Jammu & Kashmir (JK) | 1 | 0 | 0 | | | |
| Kerala (KL) | 0 | 1 | 0 | 0 | 1 | 0 |
| Karnataka (KA) | 1 | 0 | 0 | 0 | 3 | 0 |
| Maharashtra (MH) | 1 | 1 | 0 | 1 | 1 | 0 |
| Madhya Pradesh (MP) | 2 | 1 | 8 | | | |
| Mizoram (MZ) | | | | 1 | 1 | 2 |
| Punjab (PB) | 2 | 0 | 0 | | | |
| Rajasthan (RJ) | 2 | 0 | 0 | | | |
| Telangana (TG) | | | | 0 | 1 | 0 |
| Tamil Nadu (TN) | 1 | 2 | 13 | 0 | 4 | 0 |
| Uttarakhand (UT) | 2 | 0 | 0 | | | |
| Uttar Pradesh (UP) | 5* | 6 | 40 | 1 | 1 | 10 |
| West Bengal (WB) | 4 | 7 | 66* | 4* | 6* | 31* |
| Other countries & regions | | | | | | |
| Africa (country not specified) | | | | 1 | 0 | 0 |
| Bangladesh (BD) | 0 | 1 | 0 | 2 | 1* | 4.5 |
| China (CN) | 1* | 1 | 13 | | | |
| Myanmar (MM) | | | | 3* | 1* | 6* |
| Nepal (NP) | 1* | 2* | 24* | 1 | 1* | 6* |
| Nigeria (NG) | | | | 1 | 0 | 0 |
| Thailand (TH) | | | | 2 | 0 | 0 |
| United Arab Emirates (AE) | | | | 1 | 0 | 0 |
| Uzbekistan (UZ) | 0 | 1 | 0 | | | |
| Viet Nam (VN) | 0 | 1 | 0 | | | |

¹Out-degree centrality (the number of connections going to other nodes).

²In-degree centrality (the number of connections coming from other nodes).

³Betweenness centrality (the number of shortest paths in the network that must pass through a node, for native and exotic species separately).

leading to near extirpation in some areas in both India and neighbouring countries because of their capture for the bird trade (BirdLife International, 2022). There are insufficient data to estimate the scale of such trapping, and more recent data are needed on population status and trends to effectively evaluate and address this threat facing heavily traded native species. Other birds included ducks and pheasants as well as species listed in the CITES appendices, including multiple raptors, owls and songbirds. The diversity of species found could reflect in part the variety of purposes for which traded birds are used in India, including as

food, in socio-cultural activities and in spiritual practices, such as the use of owls in folk magic (Ahmed, 2010).

The media reports raised numerous animal welfare issues, including birds being hidden in pipes, shoes or garments and the taping of beaks and feathers to prevent noise. Large groups of birds were also shown being kept together in close confinement. These poor welfare conditions also indicate concerns regarding conservation and biosecurity. Some reports described birds dying during transportation, and high mortality rates have been recorded in the global bird trade (Alves et al., 2013). High mortality means that more birds must be captured or produced to replace lost stock (Martin, 2018), placing further pressure on wild populations. Cramped conditions and non-adherence to biosecurity measures also increase the risk of spreading infectious diseases, some of which could pose significant risks to human health, agriculture and the survival of threatened species in the wild (Swift et al., 2007). For instance, the global trade in parrots has been implicated in the spread of beak and feather disease virus (Fogell et al., 2018), which has been detected in exotic parrots in India (Desingu & Nagarajan, 2022). With concern growing regarding a recent global outbreak of high-pathogenicity H5N1 avian influenza (Abbasi, 2023), the findings of our study should be of particular value to decision-makers responsible for addressing biosecurity concerns.

Trade networks and routes

Network analysis suggests that a small number of states are disproportionately represented and act as major hubs in the bird trade in India. West Bengal appears to be a key trade hub and transit point for both the native and exotic bird trade and this corroborates anecdotal reports from enforcement authorities in the region (Naresh, 2018). Uttar Pradesh also appears to be a key destination and transit point for the trade in native species from multiple other states, and it acts as a gateway for trade of native species to Nepal. Although less important in terms of gatekeeping trade within the network, Tamil Nadu and Karnataka were two other destinations for trade in exotic species from Myanmar, Bangladesh and directly from Thailand and African countries. In a study of media-reported seizure events in 2020, which focused on all wildlife including non-avian species, the regions of Tamil Nadu and Karnataka were also highlighted as having large numbers of seizures (Mendis et al., 2021). Targeted monitoring and law enforcement efforts in these regions could be particularly effective at disrupting illegal trade in India and more broadly across the region.

There could be some regions that are underrepresented in media reports of seizures because of differences in enforcement effort and media coverage. For example, media reports described prominent bird-trapping sites in the Ghats and forests in Maharashtra, Karnataka, Tamil Nadu and Andhra

Pradesh, yet none of these states were prominent in reports of seizures of native birds. Differences between the data obtained from reported seizures and those obtained from testimony could indicate areas of trade that are being under-reported or underenforced and warrant further investigation.

Role of legislation and enforcement

The higher volume and network complexity of trade in native birds could reflect greater legal enforcement regarding native trade linked to differences in how the Wild Life (Protection) Act, 1972 applies to the trade and ownership of native and exotic species. Although the Act prohibits the killing, trade, export and keeping of native species, exotic species can be imported under license, and ownership and sales of exotic species within India have been largely unregulated until recently. As a result, opportunities for legal enforcement regarding exotic birds have been largely restricted to movement across international borders. The presence of high volumes of exotic CITES-listed species within India, despite few bird imports being reported by India to CITES (Poonia et al., 2022), suggests there has been poor compliance historically with CITES. India has extensive land borders with neighbouring countries, which can be difficult to monitor, and trafficking could be further facilitated by corruption.

Legislative action is currently being implemented that will facilitate the regulation of trade in exotic species. In June 2020, the Indian Government Ministry of Environment, Forest and Climate Change declared a one-time voluntary disclosure scheme in which owners of exotic species listed in CITES appendices were given a 9-month amnesty to declare and register their animals regardless of their source or legality (Ministry of Environment, Forest and Climate Change, 2020a,b), to which 32,645 people responded (Ghanekar, 2021). Changes to the Wild Life (Protection) Act, 1972 will require owners of species listed in the CITES appendices to register ownership and notify the CITES Management Authority of any transfer. Although this could provide the legal instrument for regulating exotic trade, it will require consistent enforcement to be effective.

Importantly, many exotic bird species are not listed in the CITES appendices and thus will not be subject to regulation. A recent social media study of trade in birds from West Africa highlighted India as a potential major demand centre (Davies et al., 2022). However, the commonly exported species identified in that study were largely absent from our data. The majority of these species were removed from CITES Appendix III in 2007 (CITES, 2007) and could therefore be imported, traded and owned legally in India despite little monitoring of the effects of this trade on wild populations or biosecurity risks.

Seizures indicate that action is being taken to intercept illegal wildlife trade and to enforce existing laws in India,

with enforcement efforts appearing to have increased (Naresh, 2018). However, there remain major gaps in enforcement success. Lack of capacity is a major challenge, as it is estimated that only 1% of wildlife crime is convicted by the Court of Law because of a lack of evidence and difficulties in identifying species (Ministry of Environment, Forest and Climate Change, 2019). Official government seizure data have not been systematically recorded for the last 10 years and were not made available to us in response to a data request under the Right to Information Act 2005. Once birds are seized, they are generally sent to nearby rescue centres recognized by the Animal Welfare Board of India (mostly run by NGOs) or to zoos, national parks or wildlife sanctuaries maintained by the government. Studies should determine whether these organizations at their current capacity are capable of continuing to receive high volumes of birds and consider the economic and practical feasibility of options such as wild release, rehoming or repatriation. Currently, many native birds are released into the wild by customs officials without disease checks or without following quarantine procedures. In addition, corruption amongst public officials plays a major role in illegal wildlife trade both before and after birds are seized, and without addressing this issue, changes in legislation could be undermined or inconsistently applied (Martini, 2013; Wyatt et al., 2018). Some seized birds could be fed back into the illegal wildlife trade, with one report describing that some seized birds were exported to China (Parashar, 2016).

Recommendations

A range of interventions are needed to address illegal and unsustainable bird trade in India and the biosecurity risks and animal welfare concerns associated with this trade. These should focus on various points in the commodity chain and address factors on both the supply and demand side. Regarding native species, conservation should aim to work with communities in which bird trapping is common, to identify options for community-based conservation and alternative livelihoods to alleviate poverty and to raise environmental awareness, particularly as these communities may have been previously marginalized by law enforcement and conservation efforts (Ahmed, 1997; Roe et al., 2015; Cooney et al., 2017). Captive breeding has been suggested as a means of alleviating pressure on wild birds whilst providing an alternative source of income for local communities (Jepson & Ladle, 2005). However, this approach risks leading to unintended consequences by stimulating demand that is then met through further wild-sourced trade and by facilitating illegal trade laundered through breeding facilities (Tensen, 2016). Educating consumers and establishing widespread social norms and values around responsible parrot purchasing and ownership are also vital to decrease demand for these birds.

Enforcement to tackle wildlife crime should be prioritized and capacity built at key transit locations and routes, to maximize disruption to the trade network. Consideration should also be given to the locations that are best situated for returning seized birds to the wild, which is usually best achieved close to their source locations (Indraswari et al., 2020). As well as the trade hubs identified here, further insights into locations for targeted enforcement could be gained from monitoring social media (Martin et al., 2018) or consulting regionally active NGOs, rescue centres and zoos that receive seizures, and the Wildlife Crime Control Bureau. Training for law enforcement and relevant civil service staff is also required, to obtain sufficient evidence for prosecution, particularly regarding exotic and CITES-listed species. Disrupting international bird trafficking will require intergovernmental cooperation, such as that of the ASEAN Wildlife Enforcement Network established in 2005. Many of these elements are explicitly addressed as action points and areas of specific focus in the 10-year plan proposed by the Indian Government to protect birds and their habitats, which includes a dedicated stream for tackling illegal trafficking of birds (Ministry of Environment, Forest and Climate Change, 2019).

In conclusion, our study provides basic information on key characteristics of the exotic and native bird trade in India and establishes a methodology that can be used to analyse ongoing trends in bird seizures. Further research would assist in understanding the socio-economic dimensions and drivers of trade in various species (particularly parrots), and support the design of effectively targeted interventions. Although the new legislation and plans for long-term conservation proposed by the Indian Government are promising, success will depend on addressing corruption and increasing capacity within public institutions to ensure the bird trade is managed effectively and with minimal harmful impacts.

Acknowledgements We thank Chaudhary Bansi Lal University, Bhiwani, India for providing necessary infrastructure support; Chris Shepherd for advice in designing the data collection process; and the Parrot Researcher Group for facilitating collaborations that led to the development of this study and helped bring this project to completion.

Author contributions Study conception and design: all authors; data collection: SK; data analysis: SK, AD; writing: all authors.

Conflicts of interest None.

Ethical standards This research abided by the *Oryx* guidelines on ethical standards.

References

- ABBASI, J. (2023) Bird flu has begun to spread in mammals—here's what's important to know. *JAMA*, 329, 619–621.
- AHMED, A. (1997) *Live Bird Trade in Northern India*. TRAFFIC India, New Delhi, India. portals.iucn.org/library/sites/library/files/documents/Traf-082.pdf [accessed February 2023].
- AHMED, A. (2010) *Imperilled Custodians of the Night: A Study on Illegal Trade, Trapping and Utilization of Owls in India*. TRAFFIC India/WWF-India, New Delhi, India. traffic.org/site/assets/files/3160/imperilled-custodians-of-the-night-1.pdf [accessed February 2023].
- AHMED, A. (2018) *Exotic Birds in Wildlife Trade in India: An Overview of the Growing Phenomenon*. TRAFFIC India, New Delhi, India.
- ALVES, R.R.N., LIMA, J.R.D.F. & ARAUJO, H.F.P. (2013) The live bird trade in Brazil and its conservation implications: an overview. *Bird Conservation International*, 23, 53–65.
- AVIBASE (2022) *Avibase – Bird Checklists of the World: India*. avibase.bsc-eoc.org/checklist.jsp?region=IN [accessed May 2021].
- BADOLA, S. & GAUTAM, A. (2022) *High Flying: Insight into Wildlife Trafficking through India's Airports*. TRAFFIC India, New Delhi, India. traffic.org/site/assets/files/17503/high_flying_briefing_paper.pdf [accessed February 2023].
- BHUPATHY, S., KUMAR, S.R., PALANISAMY, T., JOOTHI, P. & LEMBA, C. (2013) Wildlife exploitation: a market survey in Nagaland, north-eastern India. *Tropical Conservation Science*, 66, 241–253.
- BIRDLIFE INTERNATIONAL (2022) *Handbook of the Birds of the World and BirdLife International Digital Checklist of the Birds of the World. Version 7*. datazone.birdlife.org/userfiles/file/Species/Taxonomy/HBW-BirdLife_Checklist_v7_Dec22.zip [accessed December 2022].
- BIVAND, R., KEITT, T. & ROWLINGSON, B. (2021) *rgdal: Bindings for the 'Geospatial' Data Abstraction Library*. cran.r-project.org/web/packages/rgdal/index.html [accessed May 2022].
- BUSH, E.R., BAKER, S.E. & MACDONALD, D.W. (2014) Global trade in exotic pets 2006–2012. *Conservation Biology*, 28, 663–676.
- CARDADOR, L., TELLA, J.L., ANADÓN, J.D., ABELLÁN, P. & CARRETE, M. (2019) The European trade ban on wild birds reduced invasion risks. *Conservation Letters*, 12, e12631.
- CARDOSO, P., AMPONSAH-MENSAH, K., BARREIROS, J.P., BOUHUYS, J., CHEUNG, H., DAVIES, A. et al. (2021) Scientists' warning to humanity on illegal or unsustainable wildlife trade. *Biological Conservation*, 263, 109341.
- CHALLENGER, D.W., BROCKINGTON, D., HINSLEY, A., HOFFMANN, M., KOLBY, J.E., MASSÉ, F. et al. (2022) Mischaracterizing wildlife trade and its impacts may mislead policy processes. *Conservation Letters*, 15, e12832.
- CITES (2007) *Notification to the Parties, No. 2007/007*. CITES, Geneva, Switzerland. cites.org/sites/default/files/eng/notif/2007/E007.pdf [accessed February 2023].
- CITES (2021) *CITES Trade Database*. trade.cites.org [accessed May 2021].
- COONEY, R., ROE, D., DUBLIN, H., PHELPS, J., WILKIE, D., KEANE, A. et al. (2017) From poachers to protectors: engaging local communities in solutions to illegal wildlife trade. *Conservation Letters*, 10, 367–374.
- CSARDI, G. & NEPUSZ, T. (2006) The *igraph* software package for complex network research. *InterJournal, Complex Systems*, 1695, 1–9.
- DAVIES, A., NUNO, A., HINSLEY, A. & MARTIN, R.O. (2022) Live wild bird exports from West Africa: insights into recent trade from monitoring social media. *Bird Conservation International*, 32, 559–572.
- DESINGU, P.A. & NAGARAJAN, K. (2022) Detection of beak and feather disease virus in India and its implications. *Transboundary and Emerging Diseases*, 69, e3469–e3478.
- EBIRD (2022) *eBird India*. ebird.org/india [accessed May 2021].
- EFSA (2006) Opinion of the Scientific Panel on Animal Health and Welfare (AHAW) on a request from the Commission related with

- animal health and welfare risks associated with the import of wild birds other than poultry into the European Union. *EFSA Journal*, 4, 410.
- FOGELL, D.J., MARTIN, R.O., BUNBURY, N., LAWSON, B., SELLS, J., MCKEAND, A.M. et al. (2018) Trade and conservation implications of new beak and feather disease virus detection in native and introduced parrots. *Conservation Biology*, 32, 1325–1335.
- GEOGRAPHICAL ANALYSIS (2022) *Indian States Shapefiles*. geographicalanalysis.com/gis-blog/download-free-india-shapefile-including-kashmir-and-ladakh [accessed January 2022].
- GHANEKAR, N. (2021) 32,000 Indians say they possess Exotic Animals in Post-COVID Amnesty. *IndiaSpend*, 22 March 2021. <https://www.indiaspend.com/top-news/amnesty-scheme-shows-indians-own-thousands-of-exotic-animals-illegal-imports-covid-19-736120> [accessed August 2023].
- HANSEN, A.L.S., LI, A., JOLY, D., MEKARU, S. & BROWNSTEIN, J.S. (2012) Digital surveillance: a novel approach to monitoring the illegal wildlife trade. *PLOS One*, 7, e51156.
- HINSLEY, A., LEE, T.E., HARRISON, J.R. & ROBERTS, D.L. (2016) Estimating the extent and structure of trade in horticultural orchids via social media. *Conservation Biology*, 30, 1038–1047.
- INDRASWARI, K., FRIEDMAN, R.S., NOSKE, R., SHEPHERD, C.R., BIGGS, D., SUSILAWATI, C. et al. (2020) It's in the news: characterising Indonesia's wild bird trade network from media-reported seizure incidents. *Biological Conservation*, 243, 108431.
- JAIN, A., ALOYSIUS, S.L.M., LIM, H., PLOWDEN, T., YONG, D.L., LEE, J.G. et al. (2021) Understanding Singapore's dynamic parrot trade ecosystem. *Oryx*, 6, 184–194.
- JEPSON, P. & LADLE, R. (2005) Bird-keeping in Indonesia: conservation impacts and the potential for substitution-based conservation responses. *Oryx*, 39, 442–448.
- KHELIFA, R., ZEBBA, R., AMARI, H., MELLAL, M.K., BENSOUILAH, S., LAOUAR, A. & MAHDJOUR, H. (2017) Unravelling the drastic range retraction of an emblematic songbird of North Africa: potential threats to Afro-Palaearctic migratory birds. *Scientific Reports*, 7, 1–11.
- LOWEN, J. (2021) Uncovered: India's illegal wild bird trade hub. *Rare Bird Alert*, 2 August 2021. rarebirdalert.co.uk/v2/Content/Uncovered_Indias_illegal_wild_bird_trade_hub.aspx?s_id=714853570 [accessed May 2022].
- MARTIN, R.O. (2018) Grey areas: temporal and geographical dynamics of international trade of grey and timneh parrots (*Psittacus erithacus* and *P. timneh*) under CITES. *Emu*, 118, 113–125.
- MARTIN, R.O., SENNI, C. & D'CRUZE, N.C. (2018) Trade in wild-sourced African grey parrots: insights via social media. *Global Ecology and Conservation*, 15, e00429.
- MARTINI, M. (2013) *Wildlife Crime and Corruption. U4 Expert Answer*. transparency.org/files/content/corruptionqas/367_Wildlife_Crimes_and_Corruption.pdf [accessed December 2022].
- MENDIS, A., MOHAN, N.V., SENGOTTUVEL, R.R., SULTAN, N., SHUKLA, S., LEWIS, R. et al. (2021) *Media-Reported Wildlife Poaching and Illegal Trade in India: 2020*. Wildlife Conservation Society, Karnataka, India.
- MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE (2019) *Visionary Perspective Plan (2020–2030) for Conservation of Avian Diversity, Their Ecosystems, Habitats and Landscapes in the Country*. Ministry of Environment, Forest and Climate Change, Government of India, New Delhi, India. ourgovdotin.files.wordpress.com/2020/03/o-1.pdf [accessed May 2022].
- MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE (2020a) *Advisory for Dealing With Import of Exotic Live Species in India and Declaration of Stock*. Ministry of Environment, Forest and Climate Change, Government of India, New Delhi, India. forest.delhigovt.nic.in/advisory-dealing-import-exotic-live-species-india-and-declaration-stock [accessed May 2022].
- MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE (2020b) *Extension of Time – Advisory for Dealing With Import of Exotic Live Species in India and Declaration of Stock –Reg.* Ministry of Environment, Forest and Climate Change, Government of India, New Delhi, India. environmentclearance.nic.in/writereaddata/om/15122020ExoticDateExtend.pdf [accessed May 2022].
- NARESH, R. (2018) Bengal becomes the hub of wildlife trade in India. *India's Endangered*, 7 August 2018. indiasendangered.com/bengal-becomes-the-hub-of-wildlife-trade-in-india [accessed May 2022].
- PARASHAR, U. (2016) Indian arrested with 109 tortoises, 162 birds in Nepal. *Hindustan Times*, 17 June 2016. [hindustantimes.com/world-news/indian-arrested-with-109-tortoises-162-birds-in-nepal/story-P36B7cVvOdTJVjXi3mG7HL.html](https://www.hindustantimes.com/world-news/indian-arrested-with-109-tortoises-162-birds-in-nepal/story-P36B7cVvOdTJVjXi3mG7HL.html) [accessed August 2023].
- PAUDEL, K., HINSLEY, A., VERÍSSIMO, D. & MILNER-GULLAND, E. (2022) Evaluating the reliability of media reports for gathering information about illegal wildlife trade seizures. *PeerJ*, 10, e13156.
- POONIA, A., GHANGHAS, A., SHARMA, S., JANGRA, M. & SINDHU, V. (2022) Trends in CITES listed bird's trade in South Asian countries in view of evolution of Indian laws during last four decades. *International Journal of Ecological Economics and Statistics*, 43, 96–115.
- R CORE TEAM (2023) *R: A Language and Environment for Statistical Computing*. R Foundation for Statistical Computing, Vienna, Austria.
- ROE, D., BOOKER, F., DAY, M., ZHOU, W., ALLEBONE-WEBB, S., HILL, N.A. et al. (2015) Are alternative livelihood projects effective at reducing local threats to specified elements of biodiversity and/or improving or maintaining the conservation status of those elements? *Environmental Evidence*, 4, 1–22.
- ROSEN, G.E. & SMITH, K.F. (2010) Summarizing the evidence on the international trade in illegal wildlife. *EcoHealth*, 7, 24–32.
- SANCHEZ-MERCADO, A., CARDOZO-URDANETA, A., MORAN, L., OVALLE, L., ARVELO, M.Á., MORALES-CAMPOS, J. et al. (2020) Social network analysis reveals specialized trade in an endangered songbird. *Animal Conservation*, 23, 132–144.
- SINGH, R., SLADE, L. & ILYAS, O. (2011) Trapped and traded – an insight of field realities of live bird trade in Uttar Pradesh, India. *Birding ASIA*, 16, 45–47.
- SWIFT, L., HUNTER, P.R., LEES, A.C. & BELL, D.J. (2007) Wildlife trade and the emergence of infectious diseases. *EcoHealth*, 4, 1.
- TENSEN, L. (2016) Under what circumstances can wildlife farming benefit species conservation? *Global Ecology and Conservation*, 6, 286–289.
- WICKHAM, H. (2016) *ggplot2: Elegant Graphics for Data Analysis*. 2nd edition. Springer-Verlag, New York, USA.
- WILSON-WILDE, L. (2010) Wildlife crime: a global problem. *Forensic Science, Medicine, and Pathology*, 6, 221–222.
- WYATT, T., JOHNSON, K., HUNTER, L., GEORGE, R. & GUNTER, R. (2018) Corruption and wildlife trafficking: three case studies involving Asia. *Asian Journal of Criminology*, 13, 35–55.