

# The dynamics of songbird ownership and community interconnectedness in Singapore

WEN XUAN CHIOK<sup>1\*</sup> , REBECCA Y. Y. LEE<sup>1</sup>, JESSICA G. H. LEE<sup>2</sup> and ANUJ JAIN<sup>3,4</sup>

<sup>1</sup>*Department of Biological Sciences, National University of Singapore, Singapore 117558.*

<sup>2</sup>*Mandai Nature, 80 Mandai Lake Road, Singapore 729826.*

<sup>3</sup>*BirdLife International (Asia), 354 Tanglin Road, Singapore 247672.*

<sup>4</sup>*Nature Society (Singapore), 540 Geylang Road, Singapore 389466.*

\*Author for correspondence; e-mail: [chiokwenxuan@gmail.com](mailto:chiokwenxuan@gmail.com)

(Received 15 April 2021; revision accepted 23 August 2021)

## Summary

The practice of keeping birds is a long-held tradition in South-east Asia, including in Singapore. Beyond market surveys that have documented Singapore's sizeable bird market, there is a compelling need to understand the underlying drivers of demand for songbirds, and how these are influenced by social factors. We conducted semi-structured surveys of 114 songbird owners in Singapore, so as to determine their behaviour, demography, and preferences for owning songbirds and mapped Singapore's songbird trade network. Forty-four percent of respondents reported to not prefer either wild-caught or captive-bred birds and another 37% preferred captive-bred birds. Over half (51%) did not think that there were any differences in the singing capabilities of the songbird from either source. Influence from family members and close contacts were cited as the most influential motivational factor for bird-keeping. The majority of respondents were middle-aged (77% aged 40 and above), and two-thirds (67%) were of Chinese ethnicity. Purchasing power and socio-economic status were not deemed to be strong considerations for owning songbirds. Neither was songbird ownership regarded as a status symbol, in contrast to parrot ownership in Singapore. Instead, social factors played influential roles in the songbird community, shaping the way owners gather, interact, and trade at bird shops and bird cage hanging spots. This study offers novel insights into the motivations underlying songbird ownership and its complex community linkages. We advocate for conservation interventions to target specific demographic groups that are embedded and influenced by communities so as to promote sustainable trade in songbirds.

**Keywords:** demand reduction, songbird crisis, wildlife trade, South-east Asia, socioeconomic

## Introduction

The global trade in wildlife is a highly lucrative industry that is driven by increasing demand in certain countries, with large volumes of wildlife and their derivatives being traded both internationally and domestically (Tingley *et al.* 2017, Symes *et al.* 2018, Di Minin *et al.* 2019). Birds are the most heavily traded taxa in the live animal industry (Bush *et al.* 2014). Approximately one-third of global bird species are implicated in this trade (Nijman 2010, Ripple *et al.* 2017). While a portion of the global trade is legal and legitimate, much of the trade is illegal and underground in

nature, preventing the efficient execution of enforcement and regulation measures (Haas and Ferreira 2015, Ribeiro *et al.* 2019). This often results in overexploitation of wildlife leading to the loss of biodiversity and disruption of ecosystem processes (Broad *et al.* 2003, Wasser *et al.* 2010).

South-east Asia has been identified as a hotspot for illicit wildlife trade (TRAFFIC 2008, Nijman 2010). Vast numbers of wildlife are traded in animal markets in the region, many of which are trapped illegally (Nash 1993, Chng *et al.* 2018). Amongst bird species, parrots, and songbirds (passerines) are commonly owned pets both globally and in the region, and demand for these species has been linked to the extirpation of wild populations of many species within these groups (Eaton *et al.* 2015, Lee *et al.* 2016, Olah *et al.* 2016).

The practice of keeping songbirds is a highly popular pastime that is deeply rooted in local cultures within South-east Asia (Jepson and Ladle 2005, Kirichot *et al.* 2015, Iskandar *et al.* 2019; Fig. 1b), as well as other Asian countries like China and India (Layton 1991). This practice is one of the main contributors to the cage-bird trade in the region (Nash 1993, Marshall *et al.* 2020a). Moreover, bird singing competitions are popular in many South-east Asian countries, further

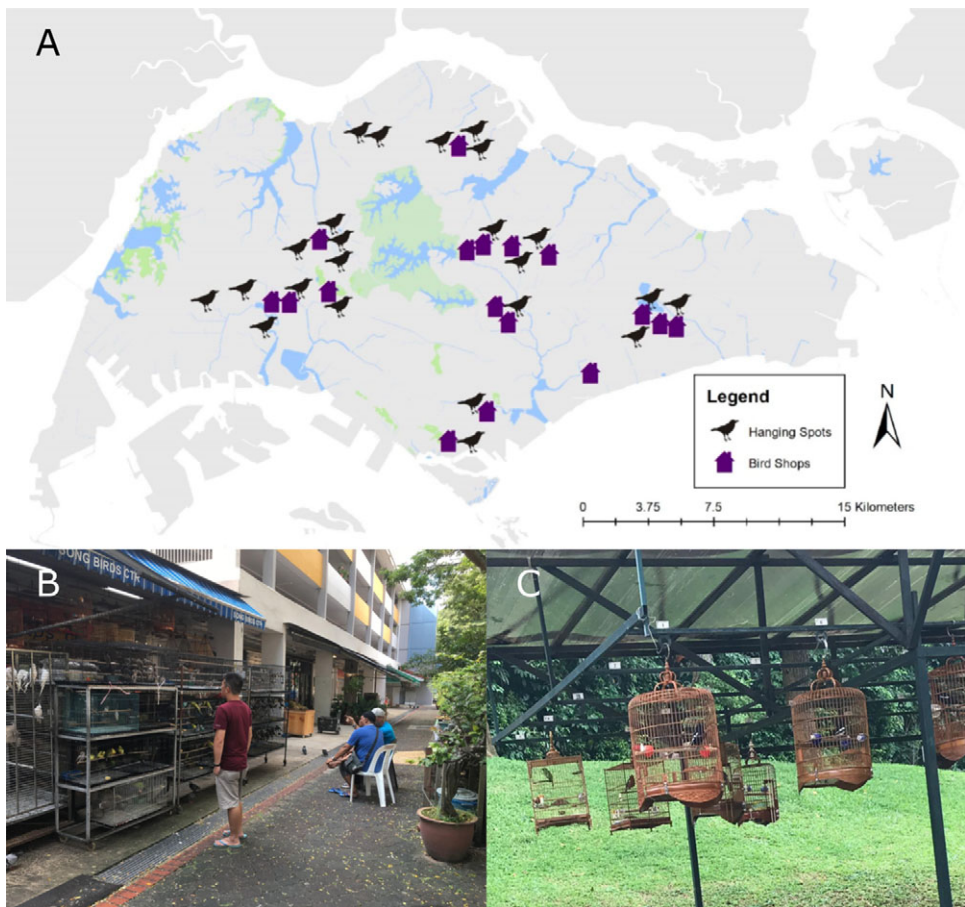


Figure 1. (a) Map indicating locations of bird shops and hanging spots found across Singapore. Symbols give an approximate location of the site and do not give the absolute number as some locations have multiple shops in close proximity. (b) Example of a bird shop in Singapore. (c) Example of a bird cage hanging spot in Singapore.

exacerbating the demand for songbirds (Jepson and Ladle 2009). The unprecedented levels of overexploitation have already led to precipitous declines of songbird species in the wild. The Straw-headed Bulbul *Pycnonotus zeylanicus* for instance, was uplisted from 'Vulnerable' to 'Critically Endangered' on the IUCN Red List within a short span of two years, following the collapse of wild populations in Thailand and Indonesia (BirdLife International 2018, Chiok *et al.* 2019).

Highly urbanised Singapore, where the keeping of pet birds (songbirds in particular) is believed to have started in the 1950s and remains prevalent, is no exception (Layton 1991, Lai 2010, Ng 2018a; Fig. 1b). There exists a highly active pet bird industry in Singapore, previously underestimated (Aloysius *et al.* 2019), and comparable to markets in Indonesian cities. At least 14,000 birds were recorded in 28 local bird shops during a market survey conducted in 2015 (Eaton *et al.* 2017). While studies have highlighted Singapore's role as a key transit hub (Shepherd *et al.* 2012, Poole and Shepherd 2016, UNODC 2016, Aloysius *et al.* 2019) and its fairly active domestic bird market (Eaton *et al.* 2017), research that focuses on the consumers is sparse.

Given Singapore's integral role in the international wild bird trade (TRAFFIC 2019), a robust understanding of the socio-economic and demographic context and the dynamics of the songbird trade are critical in implementing effective demand reduction strategies and promoting sustainable trade (Burivalova *et al.* 2017, Nuno *et al.* 2018, Veríssimo and Wan 2019, Miller *et al.* 2019). In particular, we focus on the domestic stakeholders that shape and influence the songbird community in Singapore—including the preferences, motivations, and local biodiversity knowledge of individual owners (Wasser and Jiao 2010, Theng *et al.* 2018, Doughty *et al.* 2019, Marshall *et al.* 2020b), as well as their social links and interactions within the songbird community. We thus undertook this consumer-centric study to characterise the drivers of demand for songbirds in Singapore and the key stakeholders involved. To do this, we (i) investigate the socio-economic factors and demographics of songbird owners in Singapore as well as their motivations towards owning songbirds, (ii) assess conservation awareness via their knowledge levels with regards to local fauna and nature, and lastly, (iii) map out the domestic songbird trade network in Singapore and highlight important links within the network that warrant conservation attention. The insights generated from this study will help illuminate the status of songbird trade in Singapore. It will also inform the development of songbird conservation strategies in Singapore, such as policy revisions and demand reduction programmes, and serve as baseline information for future studies to build upon from.

## Methods

### *Study design*

We first identified and visited a total of 30 out of 42 licensed bird shops and 19 cage-bird hanging spots (hereafter hanging spots) across Singapore. Across these sites, we subsequently conducted semi-structured surveys with 114 songbird owners between November 2018 and February 2019. This comprised 97 (85%) in-person and 17 (15%) digital responses.

### *Identifying bird shops and hanging spots*

We visited bird shops and their surroundings to ascertain possible locations where the survey could be conducted (Figs. 1a, 1b). Hanging spots were identified by scouting the vicinity of bird shops, through word-of-mouth and informal conversations with songbird owners. These spots possess infrastructure that allow for the hanging of multiple bird cages and could either be set up adjacent to bird shops by the owners, or standalone structures erected by private individuals or the local government (Fig. 1c). Each site (bird shop or hanging spot) was visited at least once and sites that were deemed to have higher human traffic were visited multiple times to increase the chances of obtaining responses. We recorded the location and dates of bird singing competitions that were

displayed on flyers at the sites (Fig. S1 in the online supplementary material) or online platforms such as Facebook. This enabled us to conduct opportunistic sampling during these events, where a high number of songbird owners were present.

### *Survey formulation and administration*

Bird shops and hanging spots where the survey was conducted were selected non-randomly to maximise the number of respondents. However, within each shop and hanging spot, respondents were selected via convenience sampling. Interviewers (WXC and RL) were present on-site to facilitate the recording of responses and to answer any queries posed by respondents. To reduce the impact of self-selection bias, potential respondents were asked if they were willing to participate in a survey about bird ownership in Singapore, without describing the topic or objective of the project. Additional responses were gathered via respondent-driven sampling (Newing 2011) and through continued site visits. Digital responses were collected using Google forms by posting announcements on online platforms and circulated in Telegram/WhatsApp groups via snowball sampling. The digital and print formats of the survey were identical. The data were anonymised, and no personal identifiers were collected. Overall, the face-to-face approach was favoured in this study as it had greater response rates as compared to online surveys and is usually more representative of the target population (Groves *et al.* 2009).

The survey comprised of three sections and a total of 23 questions (Appendix S1 in the online supplementary material). The sections were structured such that songbird owners were surveyed on (i) their reasons, motivations, preferences for bird-keeping and species kept; (ii) their level of conservation awareness via their knowledge of nature in Singapore, such as the native status of species (mostly birds) commonly found in the country (as with Jain *et al.* 2021) and overseas (such as hummingbirds); and (iii) respondent demographic profiles. The survey was conducted in accordance with BirdLife International and British Sociological Association guidelines.

Beyond answering the questions in the survey, some respondents also shared their opinions and anecdotal information on the role of bird shops and hanging spots about potentially illicit activities around songbird trade in Singapore including cross-border trade (Poole and Shepherd 2016) and domestic poaching (Quek 2018, Low 2020). These were documented to the extent possible (Corbin and Strauss 2008) and are presented in the results.

### *Data analyses*

All but two questions from the survey responses were analysed with descriptive statistics, but only selected results are discussed and presented in the main text. True/False questions in the second section of the survey comprised of two main questions (see questions 13 and 14 in Appendix S1) that were evaluated using a point-scoring system. A single point was given for each question answered correctly, where 0 = "Zero questions answered correctly", 1 = "One question answered correctly" and so on. As some questions were skipped by respondents, the total responses for each question are indicated where relevant. Two questions that were about buying new songbirds (see questions 10 and 12 in Appendix S1) were omitted from the analysis and not discussed here, due to the miscomprehension of the questions by respondents. Responses in the 'Others' section for relevant questions were post-processed and allocated specific categories (e.g. hobby, recreation and pastime were treated as 'pastime' for Q5, and similarly for Q4).

### *Limitations*

We acknowledge that our sample may be biased towards respondents who possess an interest in bird singing competitions and regularly partake in it because the majority of our surveys were administered near bird shops and hanging spots. However, this may well be representative of the songbird community as bird-keeping is known to be a community-focused hobby, where owners

tend to gather and socialise at sites that have infrastructure to hang bird cages (Fig. 1c). These structures tend to be multi-purpose and can sometimes be utilised as competition sites (Layton 1991, Kirichot *et al.* 2015). Additionally, some respondents may not be forthcoming or may have exhibited social desirability bias (i.e. methodically alter a response in the way that respondents perceive to be desirable by the administrator; Nancarrow and Brace 2000, Choi and Pak 2005, Smith 2007) because we asked sensitive questions about their preference for the source of birds (captive-bred or wild-caught). Taken together, these limitations imply that insights presented here may represent the best-case scenario about willingness towards songbird conservation across songbird owners in Singapore.

## Results

### *Respondent demographics*

Of the 114 respondents, 63% were songbird owners with more than 15 years of experience in bird-keeping. Approximately 6% had 11–15 years of experience, whilst the remaining 30% had 10 years or less of bird-keeping experience (Fig. S2). Respondents were predominantly male (95%) and most were of Chinese ethnicity (67%), followed by Malays (18%) and Indians (14%). Most were of age 40 years and above (77%), with a small percentage (9%) aged 30 and below (Fig. S3). The median age ranged from 51 to 60 years. Of the 89 respondents who reported their salary, 27% had monthly income levels of S\$2,500 to S\$4,999 which was somewhat above the national median (Singapore's median income in 2018 was reported to be S\$2,792; Singapore Department of Statistics 2019), whilst 33% had monthly income levels above S\$5,000. The remaining 40% of respondents had income levels below the median.

### *Popular species among songbird owners and their source*

We found that the respondents ( $n = 114$ ) reportedly kept at least 12 species of songbirds collectively. Over half of the species (58%, seven out of 12) kept by respondents are native to Singapore (Table 1). The Red-whiskered Bulbul *Pycnonotus jocosus* and White-eye *Zosterops* sp. (see Lim *et al.* 2019 for taxonomy) were the two most popular species, with 69% and 68% of respondents owning these species respectively (Table 1). This was followed by the Chinese Hwamei *Garrulax canorus* and White-rumped Shama *Kittacincla malabarica* that were owned by 33% and 22% of respondents respectively.

Amongst the top four songbird species owned, all are seen in local songbird competitions. Of these, the White-rumped Shama and White-eye are native to Singapore (Table 1). However, these two species are also regularly imported by bird shops in Singapore (Ng *et al.* 2017, WXC and RL pers. obs.), and are usually from overseas countries. Of the 12 species reportedly kept by respondents, two were globally threatened on the IUCN Red List (IUCN 2019)—the 'Critically Endangered' Straw-headed Bulbul *Pycnonotus zeylanicus*, and 'Vulnerable' Javan Myna *Acridotheres javanicus*. Only the Straw-headed Bulbul and Common Hill Myna *Gracula religiosa* are listed on Appendix II of CITES (Table 1).

We encountered 10 respondents who openly shared their past accounts of local bird trapping and cross-border smuggling. Five remarked that several of their peers regularly set up bird traps across Singapore and sold the trapped birds. Three respondents remarked that certain bird shops regularly bring in shipments of wild-caught birds of unknown legality (Table 2). However, these anecdotal personal accounts will need to be investigated further for accuracy.

### *Motivations and preferences*

When asked to select the top three factors that influenced respondents to take up bird-keeping ( $n = 114$ ), "friends and family members" was found to be the most influential factor (73%) (Fig. 2a),

Table 1. Table of songbird species kept by respondents, their native status in Singapore, whether songbird competitions are held for them, and their respective status in CITES and IUCN. Species are listed in descending order of percentage proportion reportedly owned by respondents ( $n = 114$ ).

Species	Proportion owning the species (%)	Native status (Y/N)	Competition? (Y/N)	CITES Appendix	IUCN Red List
Red-whiskered Bulbul <i>Pycnonotus jocosus</i>	69	N	Y	Not listed	Least Concern
White-eye <i>Zosterops</i> sp.	68	Y	Y	Not listed	N.A.
Chinese Hwamei <i>Garrulax canorus</i>	33	N	Y	Not listed	Least Concern
White-rumped Shama <i>Kittacincla malabarica</i>	22	Y	Y	Not listed	Least Concern
Common Hill Myna <i>Gracula religiosa</i>	6	Y	N	II	Least Concern
Javan Myna <i>Acridotheres javanicus</i>	6	N	N	Not listed	Vulnerable
Oriental Magpie-robin <i>Copsychus saularis</i>	5	Y	N	Not listed	Least Concern
White-crested Laughingthrush <i>Garrulax leucolophus</i>	4	N	N	Not listed	Least Concern
Black-naped Oriole <i>Oriolus chinensis</i>	4	Y	N	Not listed	Least Concern
Yellow-vented Bulbul <i>Pycnonotus goiavier</i>	4	Y	N	Not listed	Least Concern
Common Myna <i>Acridotheres tristis</i>	4	N	N	Not listed	Least Concern
Straw-headed Bulbul <i>Pycnonotus zeylanicus</i>	4	Y	N	II	Critically Endangered
Canary <i>Serinus canaria</i>	4	N	N	Not listed	Least Concern

however, it did not influence their decision to continue the hobby. Only one respondent selected status symbol as a motivation to bird-keeping in Singapore (Fig. 2b). Respondents who chose “personal interest” (16%) cited heritage and tradition as their reason for wanting to keep birds. Only a single respondent chose “social media” as the factor that influenced the person to take up bird-keeping. When asked what were the top motivational factors keeping them in the hobby ( $n = 114$ ), over half of the respondents (54%) chose “general interest in keeping pets” as their main motivation towards bird-keeping (Fig. 2b). This was followed by “pastime” (39%, from ‘Others’) and “interest in nature” (23%). The same group of respondents also cited their childhood exposure to nature as the factor that sparked their interest in bird-keeping. However, over half of our respondents (56%) only visited natural spaces once every few months (Fig. S4).

With regard to the source of birds (captive-bred versus wild-caught;  $n = 114$ ), 45% of respondents said it was inconsequential to them, while 38% preferred captive-bred birds (Fig. 3a). Only 17% preferred wild-caught birds. When songbird owners were asked whether captive-bred or wild-caught birds had better singing capabilities, more than half (52%) felt that there was no difference (Fig. 3a). However, 39% of respondents deemed wild-caught individuals to have better singing capabilities, with only 9% indicating captive-bred individuals to have better singing capabilities.

Table 2. Relevant illustrative quotes extracted from respondents ( $n = 10$ ).

Respondent type	Theme	No. of respondents	Representative quotes
Songbird Owner	Domestic poaching	5	"There are also bird owners that regularly trap birds and sell them to shops or other bird owners for profit...it's considered a pastime for them..."
	Transboundary smuggling	3	"Some bird shops regularly smuggle in birds...if not, how do you think they are able to display thousands of birds in their shop..."
		1	"Cannot import birds from countries with avian flu but shop owners usually have overseas connections and they use it to secure their bird shipments and make it legal to import..."
	Transboundary links	2	"Shop owners and bird-keepers all have their own connections overseas, from Malaysia to Thailand and Indonesia...they frequently share information about birds, from husbandry, breeding to coordinating shipments/consignments..."
Shop Owner	Private breeders	2	"Yes, we sometimes breed birds ourselves to sell*...we also get them from local farms and private breeders too... <i>Longtails</i> (local term for White-rumped Shamans) are the easiest to breed, whereas <i>Jambuls</i> (Red-whiskered Bulbuls) are much harder and <i>Mata Putehs</i> (White-eyes) are even harder..."
	Transboundary links	1	"We import our <i>Opeks</i> (Oriental Magpie-robin) from Penang (Peninsular Malaysia)... no problem bringing them in as we have permits..."
	Transboundary smuggling	1	"Do you know why some birds (species) are so expensive? The smugglers have to pay 'toll fees' (bribes) to immigration at each country border..."

\*This has also been observed by the authors (WXC and RL) while visiting pet bird shops during the study.

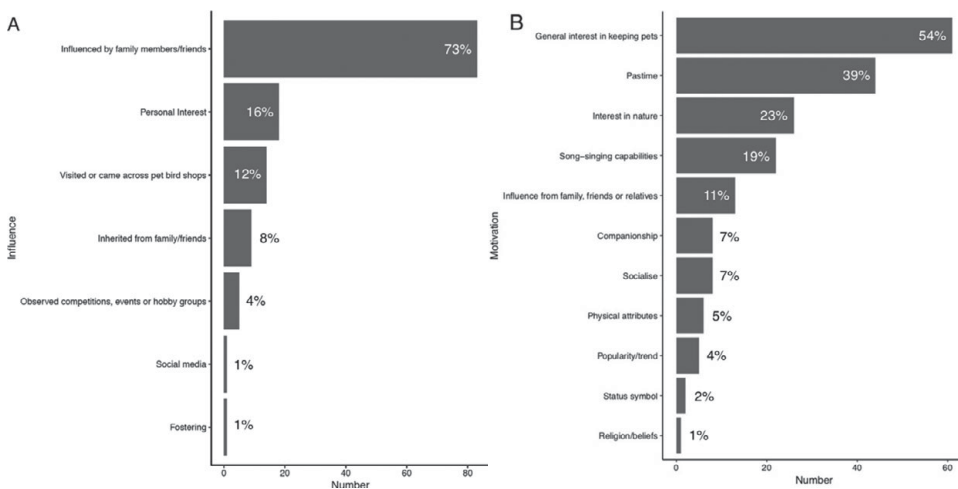


Figure 2. (a) Factors influencing respondents' entry into bird-keeping. (b) respondents' motivations toward owning songbirds after getting into the hobby ( $n = 14$ ).

When asked whether respondents bred songbirds or took part in bird singing competitions (Fig. 3b), an overwhelming majority said that they did not breed songbirds (91%, or 104 out of 114 respondents), whereas 69% took part in competitions. When questioned further, respondents that partook in breeding claimed that it was only feasible for White-rumped Shama and that local attempts at breeding the Red-whiskered Bulbul and White-eye have not been as successful as the White-rumped Shama (Table 2).

Physical bird shops were still preferred by respondents ( $n = 114$ ), who were more likely to browse (32%) and purchase (74%) songbirds through the shops, showing the continued importance of brick-and-mortar establishments (Fig. 4). Not surprisingly, at least five bird shops were observed to erect infrastructure for patrons to hang their bird cages (Fig. S5) and even host bird singing competitions. Hanging spots situated near bird shops were observed to be more likely to be frequented by owners as compared to standalone sites. Coffee shops were also observed as gathering sites for songbird owners where all matters of bird-keeping and sale of birds were discussed (WXC and RL pers. obs.). Our observations, therefore, echo those of Lai (2010), who mentioned that it is “common for bird owners to bring their pets daily to the *kopitiam* (colloquial term for coffeeshop)...cages hung on tall stands outside...birds stimulate each other to sing while their owners drink, chat and compare notes on their hobby”. Other sources of purchasing songbirds were through their friends (55%) in the form of gifts, exchanges, barter trade, private sales or via word-of-mouth exchange amongst hobbyists (Fig. 4).

More than three-quarters (82%) of respondents indicated that they were not part of any hobbyist groups, with only 13% involved in online groups (Fig. S6) and with similarly small proportions that buy (6%) and/or browse (12%) from online marketplaces (Fig. 4).

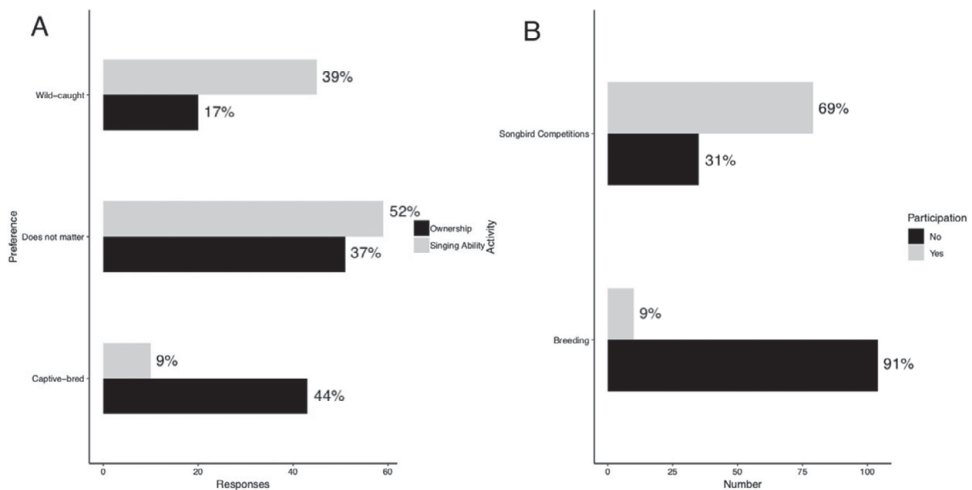


Figure 3. (a) Respondents' preference towards bird-keeping in Singapore ( $n = 114$ ). 'Ownership' refers to the respondents' preference to keep wild-caught or captive-bred individuals, if given the choice. 'Singing Ability' refers to the respondents' perceived quality of song produced by wild-caught or captive-bred birds. An option 'Does not matter' is provided for songbird owners that do not have any preference towards the background of an individual. (b) Number of respondents participating in songbird competitions or are breeding songbirds. When questioned further, many of those involved in breeding mentioned that they breed the White-rumped Shama.



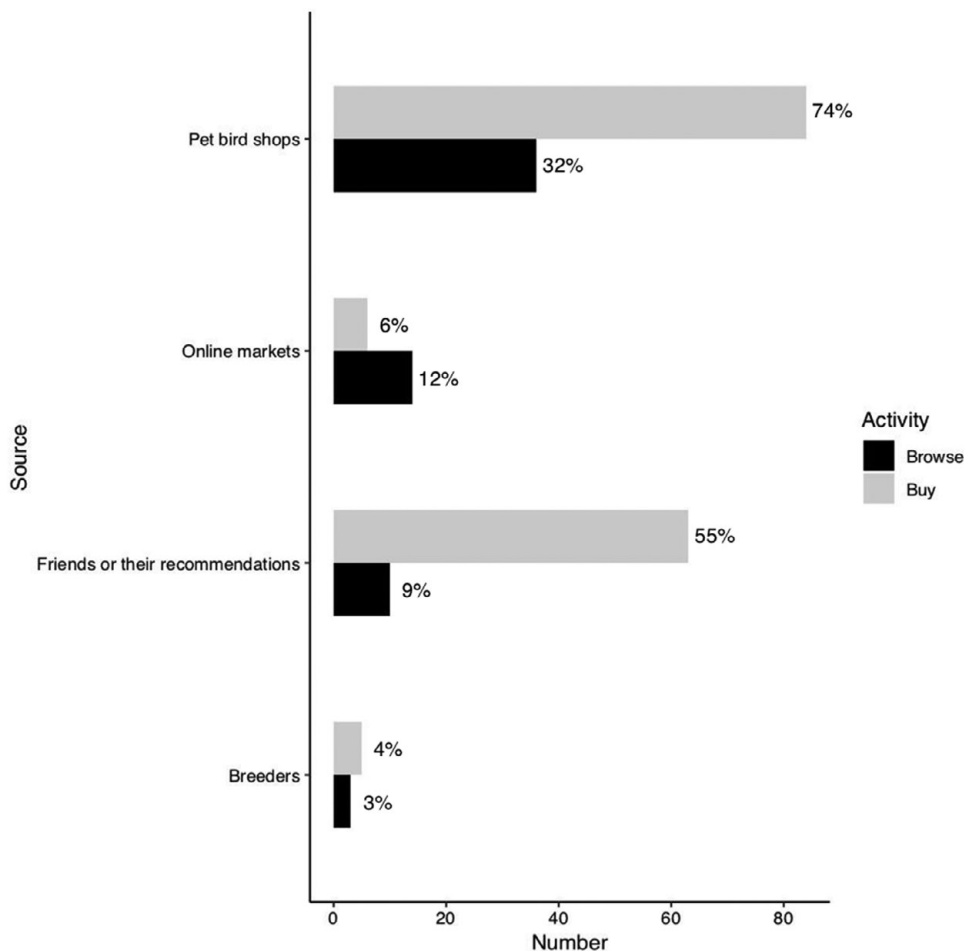


Figure 4. Sources from which respondents bought or obtained songbirds from ( $n = 114$ ). 'Online markets' represents marketplaces on social media platforms like Facebook, as well as online listings on Gumtree Singapore ([www.gumtree.sg](http://www.gumtree.sg)). 'Friends or their recommendations' refers to the exchange or sale of songbirds that an owner does not want to keep any longer (sometimes referred to as adoptions). Reasons for giving up songbirds vary from lacklustre performances at competitions, insufficient housing spaces, to purchases of new birds as replacements.

#### Conservation and biodiversity awareness

Nearly two-thirds (65%) of respondents obtained a passing score of 8 out of 15 (53%) or more regarding their knowledge about nature in Singapore (Fig. S7). However, a slightly lower proportion (59%) were able to identify 8 out of 15 or more native species. The top species that had that their native status identified correctly by respondents was the Yellow-vented Bulbul (86%). A large proportion (79%) incorrectly believed that the Red-whiskered Bulbul was native to Singapore, and 59% incorrectly indicated the White-crested Laughingthrush to be a native species—perhaps because both species have established populations in Singapore (Sodhi and Sharp 2006, Wong 2014). Nearly half (47%) failed to classify the native status of the White-rumped Shama (native to Singapore) correctly. The majority of respondents (88%) incorrectly thought that

hummingbirds where native to Singapore. They would likely have mistaken the local sunbird species as hummingbirds.

*Songbird trade network and community-based linkages*

With information gathered from multiple sources – semi-structured surveys, respondent accounts (Table 2) and references to other related studies (Poole and Shepherd 2016, Chiok and Chng 2021, Jain et al. 2021), we were able to qualitatively map out the songbird trade network in Singapore (Fig. 5). It highlighted the importance of the local community through hanging spots and bird singing competitions as the mainstay that drives and fuels songbird keeping and trade. Indeed, ‘community’ was a recurring keyword brought up by over half of the respondents during our informal conversations while conducting the surveys and was described as the main influential factor that motivated them to start bird-keeping and/or continue their hobby. Moreover, several bird shops were observed to form collaborations and/or business partnerships with local and overseas bird ownership-related suppliers or private breeders to market their businesses (Chiok and Chng 2021, Jain et al. 2021). Bird shops are also known to consign birds from private songbird owners, which includes home breeders as well as owners who may lack the know how to directly sell their birds (e.g. elderly people who are not tech-savvy). These linkages exhibit a high level of interconnectivity between commercial and private (hobbyists) entities within Singapore’s songbird community.

**Discussion**

This study provides some of the first insights on songbird ownership in Singapore, by characterising the inherent social drivers of demand (motivations and preferences), demography and knowledge levels of owners, species kept, and the mapping of the interconnectedness of Singapore’s

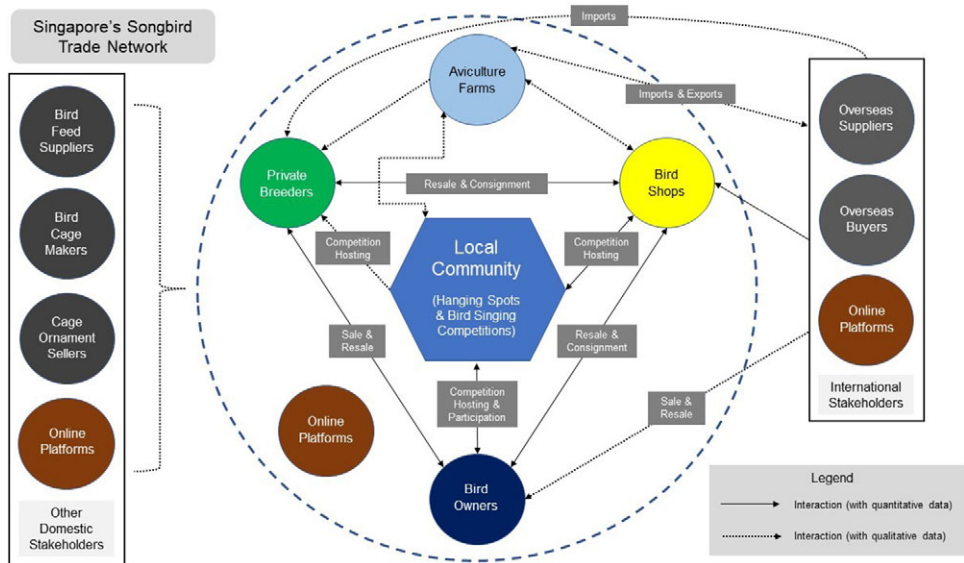


Figure 5. Overview of Singapore’s songbird trade network, depicting key domestic and international stakeholders involved the trade. Arrows indicate direction of trade flow between stakeholders. Online platforms have been found to be pervasive across the entire trade network, and as such, no arrows were associated due to its ubiquity.

songbird trade network. We show that the respondents surveyed here were experienced owners, majority of which were male, of Chinese ethnicity and aged 40 or older. These owners were motivated to pick up bird-keeping largely due to influence from their fellow family and friends, with their interest in pet keeping, nature and yearning for a pastime driving their continued pursuit in this hobby. However, owners did not seem to have a distinct preference with regard to their source of birds, despite having the notion that wild-caught birds have a better song repertoire. In the following paragraphs, we discuss the importance of socio-cultural factors within the songbird community in Singapore, the biodiversity awareness of owners and the implications for conservation.

### *Drivers of demand and influence of social elements*

Our results suggest that songbird ownership in Singapore exists within a complex social network (Fig. 5), with the community centred around hanging spots being a highly influential driver, starting with friends and family members who influenced survey respondents to take up bird-keeping. An amalgamation of physical (hanging spots), virtual (online marketplaces), commercial (bird shops) and socio-cultural factors are interwoven within the community, driving the demand for songbird ownership (Fig. 5). Bird shops, cagebird hanging spots and other informal gathering spaces (e.g. coffeeshops) serve as important social spaces to motivate, connect and bond the songbird community about their pet birds (Fig. 5; Layton 1991, Lai 2010), more so for the older individuals that make up the majority of songbird users in Singapore, and can be expected to bond at physical gatherings and events. In contrast, parrot-keeping in Singapore attracts more youth perhaps because it is portrayed as a 'fashionable hobby' by the media (Jain *et al.* 2021). Equally, the average age of songbird owners in Indonesia is also somewhat lower at approximately 40 years (Burivalova *et al.* 2017), implying that songbird keeping in Singapore may not be as fashionable anymore.

Our findings that the majority of songbird owners in Singapore were not part of any hobbyist groups, with only 13% involved in online groups, contrasts with local parrot-keeping where more than half of owners are estimated to be part of online hobbyist groups and arguably younger than songbird owners (Jain *et al.* 2021). Interestingly, no online songbird competitions have been observed in Singapore since April 2020 during COVID-19 lockdowns and restrictions on physical gatherings despite that such online competitions have emerged in Indonesia (Armstrong and Chng 2020). This may be because the songbird community in Singapore is typically older and may not be so technologically savvy, placing further emphasis on the importance of physical gatherings and community interaction (Fig. 5).

In general, online media are known to be highly popular with various types of wildlife trade in Singapore (Mahmud 2017, Sung and Fong 2018, Chiok and Chng 2021, Jain *et al.* 2021; Fig. 5), and in the region (Iqbal 2015, Krishnasamy and Stoner 2016, Indenbaum 2018, Martin *et al.* 2018), where online markets offer enhanced connectedness and anonymity to users, driving the demand for illegal trade (Grabosky 2013, Lavorgna 2014, Harrison *et al.* 2016). The importance to songbird keeping in Singapore warrants further investigation.

### *Role of songbird competitions and the importance of communities*

Bird-singing competitions appear to be an integral part of Singapore's songbird community (Ng 2018a; Fig. 5) with most songbird owners participating in them. These competitions influence which songbird species are popular as pets in Singapore. Surprisingly, competition participation rates in Singapore appear to be even higher than in Indonesia (26% in Java, 13% of Indonesia as a whole; see Jepson *et al.* 2011, Marshall *et al.* 2020a). Because the entry costs to songbird competitions in Singapore and the associated prizes are low (typically ranging from grocery vouchers to televisions and radio sets; Fig. S1), the competitions appear to be more of a social, friendly, and structured platform for songbird owners and their birds to interact, compared to the more serious

and competitive songbird competitions elsewhere in the region. For example, bird singing competition prizes in Indonesia and Thailand tend to be big where winners can walk home with luxurious cash prizes, a new car or house (Kirichot *et al.* 2015).

In Singapore, songbird ownership does not appear to be a status symbol, perhaps because of the low monetary value attached to bird-singing competitions, which can be a major avenue for publicly displaying one's collection of birds. Conversely, owning birds is considered a status symbol in Indonesia, due to cultural norms and traditions associated with bird-keeping (Jepson and Ladle 2005, Jepson *et al.* 2011) and particularly among competition contestants and breeders in Indonesia who tend to own more valuable species (Marshall *et al.* 2020b). In contrast, parrot ownership is deemed to be a form of status symbol for owners in Singapore as it is being portrayed as a fashionable hobby (Aloysius *et al.* 2019, Jain *et al.* 2021). This suggests that multiple factors such as culture, fashion and monetary rewards can influence community response towards a group of species (parrots or songbirds) for them to be regarded as status symbols.

Our study methodology and sample size did not allow us to make distinctions between preferences of songbird ownership between hobbyists and competition contestants in Singapore. Our surveys may also have underrepresented collectors and purveyors of exotic species who typically do not enter their birds into competitions. Some songbird owners who declined to partake in our survey revealed that they do not join bird song competitions and preferred to cultivate their hobby at home or at bird hanging spots (Fig. S8, Fig. 5). This may also explain the discrepancy between a low diversity of songbirds kept by respondents in our study when compared with past market surveys (Lee 2006, Eaton *et al.* 2017).

### *Indifference towards cage-bird provenance*

Intriguingly, songbird owners in our study reported indifference towards the source of the birds (wild-caught vs. captive-bred) and between the singing capabilities of wild-caught or captive-bred birds (Fig. 3). In fact, fewer songbird owners preferred wild-caught songbirds, citing the ease of training captive individuals as one of their reasons. Additionally, some respondents remarked that the training techniques employed matter more than the source of the bird and that captive-bred individuals are usually tamer and easier to train. The preferences of songbird owners in Singapore are similar to those in Indonesia, who rank convenience and availability above bird origin or song quality (Burivalova *et al.* 2017, Marshall *et al.* 2020b). This insight can be particularly useful for conservation planning, as owners surveyed here appear to have a high propensity to purchase captive-bred birds that can be sourced legally and sustainably.

### *Conservation implications and future research*

Our research has provided valuable information on songbird ownership and the interconnectedness of the songbird trade network in Singapore. This could be vital in informing conservation interventions and particularly demand reduction programs for wild-caught songbirds in Singapore and other cities in the region. Our research can also contribute to the IUCN SSC Asian Songbird Trade Specialist Group (ASTSG), particularly in the area of community engagement by providing primary data on consumer demands, motivations and preferences towards bird-keeping which is currently poorly understood outside of Indonesia.

The differences in motivation and preferences observed in songbird owners in Singapore, when compared to studies in Indonesia, underscores the need to take into consideration local factors that influence the motivations towards bird-keeping.

While consumer behaviour patterns are increasingly being recognised as significant drivers of demand, most policies concerning unsustainable wildlife trade and conservation have yet to incorporate social behavioural science to understand consumers and develop appropriate demand reduction approaches (Challender *et al.* 2015, Wallen and Daut 2018). Evidence-based conservation interventions tailored towards specific demographics (e.g. older Chinese men who are the

dominant songbird owners) and delivered through bird singing competition associations/clubs and hanging spots—rather than a general awareness-raising campaign—could likely elicit positive outcomes.

We can also draw upon lessons learned from previous successful behaviour change campaigns, such as those to reduce Singapore shark's fin consumption (WWF 2016), and ivory trade (Ng 2018b) in which biodiversity awareness-raising campaigns have been observed to have positive impacts on raising awareness of the public (Chua *et al.* 2021).

Such campaigns may be particularly useful for songbirds because the majority of respondents in Singapore appear to have no preference towards the source of songbirds or prefer captive-bred songbirds and to some extent, are knowledgeable about local biodiversity. Greater knowledge about biodiversity conservation seems to drive positive perceptions towards unsustainable forms of wildlife trade (Ivy *et al.* 1998, Shafie *et al.* 2017, Jain *et al.* 2021). Childhood exposure to nature (Ngo *et al.* 2019) and the access and frequency of visits to natural spaces are known to shape and affect one's perceptions towards conservation (Khew *et al.* 2014, Hwang *et al.* 2019).

Further research on the songbird community in Singapore with a larger sample size is warranted to understand owners' willingness to buy sustainably sourced birds. The underlying factors that shape and affect songbird owners' perceptions towards nature conservation could be tackled as well (Chiu *et al.* 2016, Richards *et al.* 2020). The quantification of socioeconomic factors of bird shop owners and songbird competition organisers in Singapore (see Miller *et al.* 2019) would also allow for an understanding of their willingness towards switching enterprises and moving towards alternative sustainable livelihoods.

## Supplementary Materials

To view supplementary material for this article, please visit <https://doi.org/10.1017/S0959270921000393>.

## Acknowledgements

We thank Madhu Rao for her guidance during the inception of the study, Janice Lee and Ding Li Yong for their invaluable feedback throughout the study, David Tan, Margie Hall and Ngo Kang Min for reviewing earlier versions of the manuscript. This research was funded by the Mandai Nature Fund (formerly Wildlife Reserves Singapore).

## References

- Aloysius, S. L. M., Yong, D. L., Lee, J. G. H. and Jain, A. (2019) Flying into extinction: Understanding the role of Singapore's international parrot trade in growing domestic demand. *Bird Conserv. Internatn.* 1–17.
- Armstrong, O. H. and Chng, S. C. L. (2020) Distancing the flock: Bird singing competitions fly online to avoid COVID-19. *TRAF-FIC Bulletin*, 32: 49–55.
- BirdLife International (2018) *Species fact-sheet: Pycnonotus zeylanicus*. <http://datazone.birdlife.org/species/factsheet/straw-headed-bulbul-pycnonotus-zeylanicus>. (Accessed 18 December 2018).
- Broad, S., Mulliken, T. and Rose, D. (2003) The nature and extent of legal and illegal trade in wildlife. Pp. 3–22 in *The trade in wildlife: Regulation for conservation*. London, UK: Earthscan.
- Burivalova, Z., Lee, T. M., Hua, F., Lee, J. S. H., Prawiradilaga, D. M. and Wilcove, D. S. (2017) Understanding consumer preferences and demography in order to reduce the domestic trade in wild-caught birds. *Biol. Conserv.* 209: 423–431.
- Bush, E. R., Baker, S. E. and Macdonald, D. W. (2014) Global trade in exotic pets 2006–2012. *Conserv. Biol.* 28: 663–676.

- Challender, D. W. S., Harrop, S. R. and Mac-Millan, D. C. (2015) Towards informed and multi-faceted wildlife trade interventions. *Glob. Ecol. Conserv.* 3: 129–148.
- Chiok, W. X., Miller, A. E., Pang, S. E. H., Eaton, J. A., Rao, M. and Rheindt, F. E. R. (2019) Regional and local extirpation of a formerly common Sundaic passerine, the Straw-headed Bulbul *Pycnonotus zeylanicus*. *Forktail* 35: 3–11.
- Chiok, W. X. and Chng, S. C. L. (2021) *Trading faces: Live animal bird trade on Facebook in Singapore*. Petaling Jaya, Malaysia: TRAF-FIC Southeast Asia.
- Chiu, H. Y., Chan, C. S. and Marafa, L. M. (2016) Local perception and preferences in nature tourism in Hong Kong. *Tourism Management Perspectives* 20: 87–97.
- Chng, S. C. L., Eaton, J. A. and Shepherd, C. R. (2018) In the market for extinction: birds for sale at selected outlets in Sumatra. *TRAF-FIC Bulletin* 30: 15–22.
- Choi, B. C. K. and Pak, A. W. P. (2005) A catalogue of biases in questionnaires. preventing chronic disease: public health research, practice and policy. *Preventing Chronic Disease*, 2: 1–13.
- Chua, M. A. H., Tan, A. and Carrasco, L. R. (2021) Species awareness days: Do people care or are we preaching to the choir? *Biol. Conserv.* 255: 109002.
- Corbin, J. and Strauss, A. (2008) *Basics of qualitative research. Techniques and procedures for developing grounded theory*. 3<sup>rd</sup> edition. Sage Publishing. <https://methods.sagepub.com/book/basics-of-qualitative-research>
- Di Minin E., Brooks, T. M., Toivonen, T., Butchart, S. H., Heikinheimo, V., Watson, J. E., Burgess, N. D., Challender, D. W., Goettsch, B., Jenkins, R. and Moilanen, A. (2019) Identifying global centres of unsustainable commercial harvesting of species. *Science Advances* 5: eaau2879.
- Doughty, H., Veríssimo, D., Tan, R. C. Q., Lee, J. S. H., Carrasco, L. R., Oliver, K. and Milner-Gulland, E. J. (2019) Saiga horn user characteristics, motivations, and purchasing behaviour in Singapore. *PLoS One*, 14: e0222038.
- Eaton, J. A., Shepherd, C. R., Rheindt, F. E., Harris, J. B. C., van Balen, S. B., Wilcove, D. S. and Collar, N. J. (2015) Trade-driven extinctions and near-extinctions of avian taxa in Sundaic Indonesia. *Forktail* 31: 1–12.
- Eaton, J. A., Leupen, B. T. C. and Krishnasamy, K. (2017) *Songsters of Singapore: An overview of the bird species in Singapore pet shops*. Petaling Jaya, Selangor, Malaysia: TRAFFIC Southeast Asia.
- Grabosky, P. (2013) Organised crime and the internet: Implications for national security. *The RUSI Journal*, 158: 18–25.
- Groves, R. M., Fowler Jr, F. J., Couper, M. P., Lepkowski, J. M., Singer, E. and Tourangeau, R. (2009) *Survey Methodology*. Second Edition. New Jersey: Wiley.
- Haas, T. C. and Ferreira, S. M. (2015) Federated databases and actionable intelligence: Using social network analysis to disrupt transnational wildlife trafficking criminal networks. *Security Informatics* 4: 1–14.
- Harrison, J. R., Roberts, D. L. and Hernandez-Castro, J. (2016) Assessing the extent and nature of wildlife trade on the dark web. *Conserv. Biol.* 30: 900–904.
- Hwang, Y. H., Yue, Z. E. J., Ling, S.K. and Tan, H. H. V. (2019) It's ok to be wilder: Preference for natural growth in urban green spaces in a tropical city. *Urban Forestry & Urban Greening* 38: 165–176.
- Indenbaum, R. A. (2018) *Viet Nam Online: A rapid assessment of e-commerce wildlife trade in Viet Nam 2017*. Cambridge, United Kingdom: TRAFFIC International.
- Iqbal, M. (2015) Looking at online bird trading in Indonesia; a case study from South Sumatra. *BirdingASIA* 24: 132–135.
- Iskandar, B. S., Iskandar, J. and Partasasmita, R. (2019) Hobby and business on trading birds: Case study in bird market of Sukahaji, Bandung, West Java and Splendid, Malang, East Java (Indonesia). *Biodiversitas J. Biol. Divers.* 20: 1316–1332.
- IUCN (2019) *The IUCN Red List of Threatened Species 2019-3*. <http://www.iucnredlist.org>. (Accessed 2 April 2019).
- Ivy, T. G. C., Road, K. S., Lee, C. K.E. and Chuan, G. K. (1998) A survey of environmental knowledge, attitudes and behaviour of students in Singapore. *Internation. Res. Geogr. Environ. Educ.* 7: 181–202.
- Jain, A., Aloysius, S. L. M., Lim, H., Plowden, T., Yong, D. L., Lee, J. G. H. and Phelps, J.

- (2021) Understanding Singapore's dynamic parrot trade ecosystem. *Oryx*, 1–11.
- Jepson, P. and Ladle, R. J. (2005) Bird-keeping in Indonesia: conservation impacts and the potential for substitution-based conservation responses. *Oryx* 39: 442.
- Jepson, P. and Ladle, R. J. (2009) Governing bird-keeping in Java and Bali: evidence from a household survey. *Oryx* 43: 364–374.
- Jepson, P., Ladle, R. J. and Sujatnika (2011) Assessing market-based conservation governance approaches: a socio-economic profile of Indonesian markets for wild birds. *Oryx* 45: 482–491.
- Khew, J. Y. T., Yokohari, M. and Tanaka, T. (2014) Public perceptions of nature and landscape preference in Singapore. *Hum. Ecol.* 42: 979–988.
- Kirichot, A., Untaya, S. and Singyabuth, S. (2015) The culture of sound: A case study of birdsong competition in Chana District, Thailand. *Asian Cult. Hist.* 7: 5.
- Krishnasamy, K. and Stoner, S. (2016) *Trading faces: A rapid assessment on the use of Facebook to trade wildlife in Peninsular Malaysia*. Petaling Jaya, Selangor, Malaysia: TRAFFIC Southeast Asia.
- Lai, A. E. (2010) The kopitiam in Singapore: An evolving story about migration and cultural diversity. *Asia Research Institute, Working Paper Series*, 132.
- Lavorgna, A. (2014) Wildlife trafficking in the internet age. *Crime Science* 3: 5.
- Layton, L. (1991) *Songbirds in Singapore*. Oxford, UK: Oxford University Press.
- Lee, S. H. J. (2006) *Wildlife trade in Singapore. A review on the pet bird trade. Dissertation*. Department of Biological Sciences, National University of Singapore.
- Lee, J. G. H., Chng, S. C. L. and Eaton, J. A. (2016) *Conservation strategy for Southeast Asian songbirds in trade. Recommendations from the first Asian Songbird Trade Crisis Summit 2015 held in Jurong Bird Park, Singapore, 27–29 September 2015*. TRAFFIC and Wildlife Reserves Singapore.
- Lim, B. T., Sadanandan, K. R., Dingle, C., Leung, Y. Y., Prawiradilaga, D. M., Irham, M., Ashari, H., Lee, J. G. H. and Rheindt, F. E. R. (2019) Molecular evidence suggests radical revision of species limits in the great speciator white-eye genus *Zosterops*. *J. Ornithol.* 160: 1–16.
- Low, Y. J. (2020) *MP Louis Ng introduces private member's bill to better protect wildlife, crack down on poachers*. TODAY Online, Singapore. <https://www.todayonline.com/singapore/mp-louis-ng-introduces-private-members-bill-better-protect-wildlife-impose-tougher> (Accessed 6 March 2020).
- Mahmud, A. H. (2017) Illegal trade shifts online. The Straits Times, Singapore <https://www.straitstimes.com/singapore/illegal-trade-shifts-online> (Accessed 12 December 2020).
- Marshall, H., Collar, N. J., Lees, A. C., Moss, A., Yuda, P. and Marsden, S. J. (2020a) Spatio-temporal dynamics of consumer demand driving the Asian Songbird Crisis. *Biol. Conserv.* 241: 108237.
- Marshall, H., Collar, N. J., Lees, A. C., Moss, A., Yuda, P. and Marsden, S. J. (2020b) Characterizing bird-keeping user-groups on Java reveals distinct behaviours, profiles and potential for change. *People and Nature* 2020: 1–12.
- Martin, R. O., Senni, C. and D'Cruze, N. C. (2018) Trade in wild-sourced African grey parrots: Insights via social media. *Glob. Ecol. Conserv.* 15: e00429.
- Miller, A. E., Gary, D., Juhardiansyah, Sagita, N., Muflihati, Kartikawati and Adirahmanta, S. N. (2019) Socioeconomic characteristics of songbird shop owners in West Kalimantan, Indonesia. *Trop. Conserv. Sci.* 12: 1–9.
- Nancarrow, C. and Brace, I. (2000) Saying the "right thing": Coping with social desirability bias in marketing research. *Bristol Business School Teaching and Research Review* 3: 1–11.
- Nash, S. V. (1993) *Sold for a song: The trade in Southeast Asian non-CITES birds*. Cambridge, UK: TRAFFIC International.
- Newing, H. (2011) *Conducting research in conservation: a social science perspective*. London and New York: Routledge
- Ng, E. Y. X., Garg, K. M., Low, G. W., Chattopadhyay, B., Oh, R. R. Y., Lee, J. G. H. and Rheindt, F. E. (2017) Conservation genomics identifies impact of trade in a threatened songbird. *Biol. Conserv.* 214: 101–108.

- Ng, J. H. (2018a) *The last bird-singing clubs of Singapore*. The culture trip. <https://theculturetrip.com/asia/singapore/articles/the-last-bird-singing-clubs-of-singapore/> (Accessed 20 February 2019).
- Ng, J. (2018b) *The inside scoop on Ivory Lane*. Worldwide Fund for Nature, Singapore. <https://blog.wwf.sg/endangered-species/2018/08/the-inside-scoop-on-ivory-lane/> (Accessed 22 November 2020).
- Ngo, K. M., Hosaka, T. and Numata, S. (2019) The influence of childhood nature experience on attitudes and tolerance towards problem-causing animals in Singapore. *Urban Forestry & Urban Greening* 41: 150–157.
- Nijman, V. (2010) An overview of international wildlife trade from Southeast Asia. *Biodivers. Conserv.* 19: 1101–1114.
- Nuno, A., Blumenthal, J. M., Austin, T. J., Bothwell, J., Ebanks-Petrie, G., Godley, B. J. and Broderick, A. C. (2018) Understanding implications of consumer behaviour for wildlife farming and sustainable wildlife trade. *Conserv. Biol.* 32: 390–400.
- Olah, G., Butchart, S. H., Symes, A., Guzmán, I. M., Cunningham, R., Brightsmith, D. J. and Heinsohn, R. (2016) Ecological and socio-economic factors affecting extinction risk in parrots. *Biodivers. Conserv.* 25: 205–223.
- Poole, C. M. and Shepherd, C. R. (2016) Shades of grey: The legal trade in CITES-listed birds in Singapore, notably the globally threatened African grey parrot *Psittacus erithacus*. *Oryx* 51: 411–417.
- Quek, X. H. (2018) Status of poaching in Singapore: an investigation of its occurrence, diversity and distribution from Dec 2014 to Jan 2018. Dissertation. Department of Biological Sciences, National University of Singapore.
- Ribeiro, J., Reino, L., Schindler, S., Strubbe, D., Vall-llosera, M., Araújo, M. B., Capinha, C., Carrete, M., Mazzoni, S., Monteiro, M. and Moreira, F. (2019) Trends in legal and illegal trade of wild birds: A global assessment based on expert knowledge. *Biodivers. Conserv.* 28: 3343–3369.
- Richards, D. R., Fung, T. K., Leong, R. A., Sachidhanandam, U., Drillet, Z., Edwards, P. J. (2020) Demographic biases in engagement with nature in a tropical Asian city. *PLoS One* 15: e0231576.
- Ripple, W. J., Wolf, C., Newsome, T. M., Hoffmann, M., Wirsing, A. J. and McCauley, D. J. (2017) Extinction risk is most acute for the world's largest and smallest vertebrates. *Proc. Natl. Ac. Sci. USA* 114: 10678–10683.
- Shafie, N. J., Sah, S. A. M., Mutalib, A. H. A. and Fadzly, N. (2017) General perceptions and awareness level among local residents in Penang Island toward bats conservation efforts. *Trop. Life Sci. Res.* 28: 31.
- Shepherd, C. R., Stengel, C. J. and Nijman, V. (2012) *The export and re-export of CITES-listed birds from the Solomon Islands*. Petaling Jaya, Selangor, Malaysia: TRAFFIC Southeast Asia.
- Singapore Department of Statistics (2019) *Key household income trends, 2018. Household income, publications and methodology*. Singapore Department of Statistics. <https://www.singstat.gov.sg/-/media/files/publications/households/pp-525.pdf> (Accessed 13 July 2019).
- Smith, W. W. (2007) Social desirability bias and exit survey responses: The case of a first nations campground in Central Ontario, Canada. *Tourism Manage.* 28: 917–919.
- Sodhi, N. S. and Sharp, I. (2006) *Winged invaders: pest birds of the Asia Pacific with information on bird flu and other diseases*. Singapore: SNP International Publishing.
- Sung, Y. H. and Fong, J. J. (2018) Assessing consumer trends and illegal activity by monitoring the online wildlife trade. *Biol. Conserv.* 227: 219–225.
- Symes, W. S., McGrath, F. L., Rao, M. and Carrasco, L. R. (2018) The gravity of wildlife trade. *Biol. Conserv.* 218: 268–276.
- Theng, M., Glikman, J. A. and Milner-Gulland, E. J. (2018) Exploring Saiga horn consumption in Singapore. *Oryx*, 52: 736–743.
- Tingley, M. W., Harris, J. B. C., Hua, F., Wilcove, D. S. and Yong, D. L. (2017) The pet trade's role in defaunation. *Science* 356: 916.
- TRAFFIC (2008) *What's driving the wildlife trade? A review of expert opinion on economic and social drivers of the wildlife trade and trade control efforts in Cambodia*,



- Indonesia, Lao PDR and Vietnam. East Asia and Pacific Region Sustainable Development Discussion Papers. Washington DC: The World Bank.
- TRAFFIC (2019) *Reducing demand for illegal wildlife products: Conference proceedings, Bangkok, Thailand, 28–30 November 2018*. Cambridge, UK: TRAFFIC International.
- UNODC (2016) *World wildlife crime report: Trafficking in protected species, 2016*. Vienna, Austria: United Nations Office on Drugs and Crime.
- Veríssimo, D. and Wan, A. K. (2019) Characterizing efforts to reduce consumer demand for wildlife products. *Conserv. Biol.* 33: 623–633.
- Wallen, K. E. and Daut, E. (2018) The challenge and opportunity of behaviour change methods and frameworks to reduce demand for illegal wildlife. *Nat. Conserv.* 26: 55.
- Wasser, R. M. and Jiao, P. B. (2010) *Understanding the motivations: the first step toward influencing China's unsustainable wildlife consumption*. Hong Kong: TRAFFIC East Asia.
- Wasser, S., Poole, J., Lee, P., Lindsay, K., Dobson, A., Hart, J., Douglas-Hamilton, I., Wittemyer, G., Granli, P., Morgan, B. and Gunn, J. (2010) Elephants, ivory and trade. *Science*, 327(5971): 1331–1332.
- Wong, F. S. H. (2014) The spread and relative abundance of the non-native White-crested Laughingthrush *Garrulax leucolophus* and Lineated Barbet *Megalaima lineata* in Singapore. *Forktail* 30: 90–95.
- WWF (2016) *Singapore: Shark fin consumer survey*. WWF Singapore, Singapore.