**Supplementary Material**

Flying into extinction: Understanding the role of Singapore’s international parrot trade in growing domestic demand

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Table S1. Definition of terms used in this study.

|  |  |
| --- | --- |
| **Term** | **Explanation** |
| CITES | Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), ensure that the global trade of wild animals and plants do not threaten their survival. |
| AVA | Agri-food and Veterinary Authority of Singapore, CITES trade authority in Singapore.  |
| Appendix I | Species threatened with extinction, trade in specimens of these species is permitted only in exceptional circumstances.  |
| Appendix II | Species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival. |
| Appendix III | Species that are protected in at least one country, which has asked other CITES Parties for assistance in controlling the trade.  |
| IUCN  | The International Union for Conservation of Nature (IUCN) assesses the conservation status of species to highlight taxa threatened with extinction, and therefore promote their conservation. |
| IUCN—NE | Not Evaluated |
| IUCN—EN | Data Deficient |
| IUCN—VU | Least Concern |
| IUCN—NT | Near Threatened |
| IUCN—VU | Vulnerable |
| IUCN—EN | Endangered |
| IUCN—CR | Critically Endangered |
| IUCN—EW | Extinct in the Wild |
| IUCN—EX | Extinct |

Table S2. Top 10 CITES imports and exports of birds in Singapore from 2005 to 2016.

|  |  |  |
| --- | --- | --- |
| Common name | Scientific name  | Number |
| Top 10 imports |
| African grey parrot | *Psittacus erithacus* | 76805 |
| Monk parakeet | *Myiopsitta monachus* | 45554 |
| Sun parakeet | *Aratinga solstitialis* | 23859 |
| Senegal parrot | *Poicephalus senegalus* | 19319 |
| Fischer's lovebird | *Agapornis fischeri* | 20258 |
| Yellow-collard lovebird | *Agapornis personatus* | 13976 |
| Red-fronted parrot | *Poicephalus gulielmi* | 15749 |
| Yellow-bibbed lory | *Lorius chlorocercus* | 9912 |
| Solomons cockatoo | *Cacatua ducorpsii* | 7584 |
| Eclectus parrot | *Eclectus roratus* | 7152 |
| Top 10 exports |
| African grey parrot | *Psittacus erithacus* | 57347 |
| Yellow-fronted canary | *Serinus mozambicus* | 17415 |
| Monk parakeet | *Myiopsitta monachus* | 30581 |
| Common hill myna | *Gracula religiosa* | 7544 |
| Sun parakeet | *Aratinga solstitialis* | 10511 |
| Senegal parrot | *Poicephalus senegalus* | 8462 |
| Eclectus parrot | *Eclectus roratus* | 5462 |
| White-rumped seedeater | *Serinus leucopygius* | 4400 |
| Red lory | *Eos rubra* | 3803 |
| Red-fronted parrot | *Poicephalus gulielmi* | 5767 |

Table S3. Parrot importing and exporting markets via Singapore, from 2005 to 2016.

|  |  |
| --- | --- |
| Countries exporting parrots to Singapore | Countries importing parrots from Singapore |
| Code | Country | No. of parrots | Code | Country | No. of parrots |
| NL | Netherlands | 34542 | TW | Taiwan, China | 107295 |
| SB | Solomon Islands | 25530 | JP | Japan | 11996 |
| ZA | South Africa | 25108 | AE | United Arab Emirates | 5889 |
| CD | Congo, Democratic Republic of the | 25001 | CN | China | 3909 |
| GN | Guinea | 16658 | NL | Netherlands | 2936 |
| UY | Uruguay | 14130 | HK | Hong Kong | 2921 |
| GY | Guyana | 13404 | MY | Malaysia | 2915 |
| SR | Suriname | 10891 | ES | Spain | 1264 |
| TW | Taiwan, China | 10716 | TH | Thailand | 1051 |
| CF | Central African Republic | 10415 | PT | Portugal | 925 |
| LR | Liberia | 7480 | CZ | Czech Republic | 859 |
| CI | Côte D'ivoire   | 5888 | DK | Denmark | 854 |
| PH | Philippines | 4268 | ID | Indonesia | 827 |
| AR | Argentina | 3812 | PH | Philippines | 748 |
| ML | Mali | 3077 | IT | Italy | 444 |
| PE | Peru | 2827 | DE | Germany | 232 |
| ES | Spain | 2532 | BN | Brunei Darussalam | 127 |
| BE | Belgium | 2178 | RS | Serbia | 104 |
| IN | India | 652 | BE | Belgium | 100 |
| SN | Senegal | 600 | CS | Former Serbia and Montenegro | 100 |
| OM | Oman | 597 | BR | Brazil | 97 |
| MZ | Mozambique | 538 | PK | Pakistan | 87 |
| BH | Bahrain | 410 | ZA | South Africa | 86 |
| US | United States of America | 358 | OM | Oman | 67 |
| NI | Nicaragua | 353 | TR | Turkey | 49 |
| AE | United Arab Emirates | 344 | IL | Israel | 25 |
| NZ | New Zealand | 244 | MM | Myanmar | 13 |
| XX | Unknown | 200 | IN | India | 10 |
| CG | Congo | 135 | RU | Russian Federation | 10 |
| IL | Israel | 29 | BH | Bahrain | 6 |
| DE | Germany | 14 | QA | Qatar | 4 |
|  |  |  | CA | Canada | 2 |
|  |  |  | BD | Bangladesh | 1 |
|  |  |  | NP | Nepal | 1 |

Table S4. Imports and exports of top 3 markets from 2005 to 2016.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** |
| **Singapore's imports from top 3 exporting countries** |
| 1 Netherlands | 9628 | 128 | 0 | 660 | 0 | 370 | **12054** | 9667 | 537 | 1054 | 264 | 180 |
| 2 Solomon Islands | **18250** | 1750 | 3720 | 780 | 1030 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 South Africa | 0 | 0 | 2004 | 4621 | 6238 | **7977** | 4268 | 0 | 0 | 0 | 0 | 0 |
| 3 Democratic Republic of the Congo  | 0 | 2340 | 2235 | 1910 | 1610 | 1600 | 3500 | **5110** | 1699 | 2047 | 2000 | 950 |
| Total (top 3 countries) | 27878 | 4218 | 7959 | 7971 | 8878 | 9947 | 19822 | 14777 | 2236 | 3101 | 2264 | 1130 |
| Total (all countries) | 59305 | 26111 | 16845 | 16535 | 13205 | 16302 | 25299 | 21328 | 4645 | 5367 | 9086 | 8903 |
| **Singapore's exports to top 3 importing countries** |
| 1 Taiwan | **35619** | 12105 | 6727 | 5620 | 5414 | 6746 | 6405 | 6747 | 3607 | 2934 | 7297 | 8074 |
| 2 Japan | 2058 | **3211** | 901 | 549 | 269 | 527 | 593 | 982 | 765 | 717 | 504 | 920 |
| 3 UAE | 223 | **2070** | 1894 | 1696 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| Total (top 3 countries) | 37900 | 17386 | 9522 | 7865 | 5683 | 7273 | 6998 | 7729 | 4372 | 3651 | 7801 | 9000 |
| Total (all countries) | 45179 | 20168 | 10081 | 8726 | 7052 | 9120 | 7505 | 10124 | 4549 | 3995 | 7802 | 10224 |
| Highest annual import/ export per country in **bold**;Top two highest annual import/ export (total) underlined |

Table S5. Total number of species and abundance of birds recorded and the survey effort in previous market surveys conducted in Singapore.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Study   | Number of species recorded | Number of individuals recorded (abundance)  | Number of shops surveyed | Survey Effort |
| Duration | Number of surveys |
| Nash, 1993\* | 247 | 128,000 | 47 | 17 Months (Jan92 to May93)  | 252 |
| Lee, 2006 | 172 | 14,194 | 24 | 6 Months (Aug05 to Jan06)  | 47 |
| Eaton et al., 2016 | 109 | 14,085 | 28 | 4 days(4,5 Nov & 6,7 Dec15) | - |
| ACRES, 2016\*\* | N.A. | N.A. | 45 | 2 Months(Aug16 to Sep16) | 45 |
| \* Nash (1993) only surveyed non-CITES birds.\*\* ACRES (2016) conducted a survey of pet shop conditions |

Table S6. Price of birds in Singapore reported in market surveys by researchers and in news sources.

|  |
| --- |
| Lee, 2006 |
| Type of Bird | Price Range (SGD$) | Sample Size |
| **Large Parrots (macaws & cockatoos)**  | **3,000-5,000** | **130** |
| **Small Parrots (parakeets & lories)**  | **200-800** | **545** |
| Songbirds, *Passeri* | 30-100 | 9,817 |
| Prayer birds (e.g. sparrows) | 2-5 | 6 |
| Straits Times, 2014 |
| Type of Bird | Price Range (SGD$) | Sample Size |
| **Hyacinth Macaw,** *Anodorhynchus hyacinthinus* | **35,000-40,000** | **-** |
| **Macaw,** *Arinae* | **3,000-7,000** | **-** |
| **African Grey Parrot,** *Psittacus erithacus* | **850-1,000** | **-** |
| **Cockatiels,** *Nymphicus hollandicus* | **150** | **-** |
| Eaton et al., 2017 |
| Type of Bird  | Price Range (SGD$) | Sample Size  |
| **African Grey Parrot,** *Psittacus erithacus* | **1,900** | **3** |
| Oriental White-eye, *Zosterops palpebrosus* | 80-200 | 6,473 |
| White-rumped Shama, *Copsychus malabaricus* | 20 | 155 |
| Oriental Magpie Robin, *Copsychus saularis* | 20 | 24 |
| Chinese Hwamei, *Garrulax canorus* | 20 | 21 |
| Red-whiskered Bulbul, *Pycnonotus jocosus* | 12 | 2,811 |
| White-eyes, *Zosteropidae* sp.  | 12 | 6,473 |
| Parrots in  **BOLD** |  |

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Table S7. List of top 10 birds surveyed in pet shops in Singapore by previous researchers.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Common Name** | **Species** | **Nash, 1993** | **Lee, 2006** | **Eaton et al., 2016** | **Total number of birds** |
| Zebra Dove | *Geopelia striata* | 28,950 | 1,767 | 1,227 | 31,944 |
| Scaly-breasted Munia | *Lonchura punctulata* | 23,350 | 686 | 699 | 24,735 |
| Oriental White-eye | *Zosterops palpebrosus* | 10,800 | 4,884 | 6,473 | 22,157 |
| Red-whiskered Bulbul | *Pycnonotus jocosus* | 12,050 | 1,907 | 2,811 | 16,768 |
| White-head Munia | *Lonchura maja* | 12,550 |  | 494 | 13,044 |
| Black head Munia | *Lonchura atricapilla* | 5,150 |  |  | 5,150 |
| Hill myna | *Gracula religiosa* | 4,750 |  |  | 4,750 |
| White-rumped Shama | *Copsychus malabaricus* | 3,200 |  | 155 | 3,355 |
| White-rump Munia | *Lonchura striata* | 2,800 |  |  | 2,800 |
| Red billed Leiothrix | *Leiothrix lutea* | 2,100 |  |  | 2,100 |
| Munias | *Lonchura sp.* |  | 1,461 |  | 1461 |
| Red Avadavat | *Amandava amandava* |  | 147 | 1,030 | 1177 |
| **Budgerigar** | *Melopsittacus undulatus* |  | 667 |  | 667 |
| Spotted-necked Dove | *Spilopelia chinensis* |  | 239 |  | 239 |
| Bronze Mannikin | *Lonchura cucullata* |  |  | 220 | 220 |
| **Cockatiels** | *Nymphicus hollandicus* |  | 209 |  | 209 |
| Yellow Canary | *Crithagra flaviventris* |  | 208 |  | 208 |
| **Monk Parakeet** | *Myiopsitta monachus* |  |  | 96 | 96 |
| **Rose-ringed Parakeet** | *Psittacula krameri* |  |  | 89 | 89 |
| Parrots in **BOLD**.  |

Figure S1. (a) Percentage imports of CITES-listed parrots from Singapore’s top three import markets from 2005 to 2016 (b) Percentage imports of CITES-listed parrots from Singapore’s top three export markets from 2005 to 2016.

Figure S2. Semi-structured interview quotes (interviewee number in parenthesis).

|  |
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| *Announcements were posted on the following online forums – National University of Singapore’s Integrated Virtual Learning Environment, Tembusu College Facebook group, Singapore Birders Facebook group, Parrot World Singapore Facebook group and the Nature Society (Singapore) or (NSS) mailing list—to seek parrot owners willing to be interviewed.***Motivations for keeping parrots*** “I came across a bird at a pet shop, I felt sorry, I thought it was a nice companion to have at home.” (11)
* “My friend brought me to a pet shops and I ended up buying two cockatiels” (17)
* “My friends encouraged me to own parrots, they showed me how they interacted with their parrots, it looked very fun, i was attracted.” (27)
* “My colleague had a ringneck, it looked realy colorful and nice, when I saw it I wanted it too.” (29)
* “When I was young, I went to a quail farm, and that was when I started to like birds” (22)
* “I would still keep a captive bred parrot (even if its endangered), it is still better than leaving them kept in cages in the bird shop.” (5)
* “I didn’t want him to be stuck in a pet shop, in a not so big cage.” (11)
* “When I went to the pet shop I had no intention to keep the parrot. The longer my husband put me there, I knew I would come out with something.” (16)
* “For the fourth parrot, I went to bird shop to buy bird food, I actually had zero intention of getting a bird but then saw one at a bird shop and it looked so cute, so tame.” (22)
* “I wanted to find a male companion for my female bird” (20)
* “To have only one bird is quite sad so I got a second one, to accompany my first one” (22)
* “I enjoy the free flying of parrots whereby u keep them as pet and enable them to fly freely in the sky and recall back.” (24)
* “For my haagromo budgie, I first saw on Facebook, someone posted a picture of it, and I was very keen on getting it” (16)
 |
| **Considerations when purchasing a parrot** * “Size and color is important because they are nicer looking.” (2)
* “I prefer smaller birds because they are easier to maintain as compared to big ones, we are not living in a very big house” (20)
* “I also like colorful, bright looking parrots.” (26)
* “To me it's about having a pet and not so much about it’s rarity, affinity is important, we selected the parrot from the bird shop based on affinity.” (6)
* “It was affinity, feeling. I didn’t want him to be stuck in a pet shop, in a not so big cage.” (11)
* “We bought the African Grey because of its intelligence and how well it could speak, and possibly because it is very good as a companion.” (8)
* “We will exchange birds if they are hard to train and become too noisy or if they bite.” (2)
* “I want parrots who are easy to train that is why I get young birds.” (18)
* “Experienced pet keepers want rare pets, if others have the pet too, what is the point?” (7)
* “I like to keep those that are not so easily available; like caiques.” (9)
* “I care about where it is being caught, but my parents would just buy from the bird shop without asking about the source.” (2)
* “Captive bred, so i feel less guilty compared to wild caught.” (5)
* “I like young birds, because I like feeding them. Also, it is easier to train the young birds, they are more tame, the adult parrots can be very unpredictable.” (22)
 |
| **Popularity of parrots in Singapore*** “They are more exotic, and different from dogs which only have few colors.” (1)
* “They are intelligent creatures, more and more people start to realize that they can be cuter than dogs.” (27)
* “It is because people are getting richer, and they can afford more exotic pets rather than cats and dogs.” (8)
* “Some people want to look good by owning an expensive parrot” (21)
* “Sometimes, people just want an instagrammable photo with their parrots and their toys.” (23)
* “There are restrictions on owning dogs and cats in houses in Singapore.” (6)
* “ The are not much regulations for parrot ownership in Singapore, not specific cage sizes etc…” (20)
* “Through social media many are introduced and made aware of parrots capability and how cute, adorable, intelligent they are” (24)
* “Recently over the years, there are many different (news) articles on parrot ownership and exotic birds, so people start to get interested in owning birds.” (16)
* “There was a (news) article published on parrot ownership, guy being parrot owner, parrots become more known, people realize they can actually keep a parrot.” (22)
* “Many people start to join the facebook group, there is a community to free-fly your parrots, talk about your parrots.” (17)
* “When parrot owners meet non-parrot owners during events, the non-parrot owners will get to see the parrots start getting interested in keeping parrots.” (20)
* “There is greater awareness on parrots because of the facebook group created, more parrots owners can get together, it is like a community.” (20)
* “There are a lot of bird groups, promoting the hobby. Some groups have hidden agenda, a desire to sell products.” (19)
* “Past 3-4 years, there are Facebook groups, there is a community, every week they have free-flight events so everyone gathers.” (22)
* “More parrot groups like Birdies and Family, Birdcraze that share information on how to care for parrots.” (28)
* “We like to influence other people to own parrots, we call it “parrot poisoning”, we share our passion about owning parrots with others.” (17)
* “People influence others, I don’t do it myself, I never mean to advertise that I have birds. People in the parrot community use the word “poison”, I “poison my friends to own a bird”. They play up the positive aspects of the birds and not the negatives, like the cost” (18)
* “People in the bird group say that you will get addicted to owning more parrots, it is a theme across the bird group.” (18)
* “We have this term in the parrot community called “poisoning”, after getting one parrot, we just want more and more.” (19)
* “They have a strong influence to get people to buy (parrots), especially their friends.” (7)
* More bird shops are bringing in parrots. (25)
* “Sometimes people impulsively buy when they go into the bird shop, I just want one because it is “cute” and add to their collection.” (18)
* “Some people think that want to start off with small parrots, to train their ability to care for parrots, they then “upgrade” to bigger parrots after a while, and keep on buying bigger parrots. I think this is very wrong.” (26)
* “Birds can fly and come back, the thrill of that got people interested, they think it is very cool” (22)
 |