Developing New Policy Instruments to Regulate Consumption of Wild Birds: Socio-Demographic Characteristics of Bird-Keeping in Java and Bali

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Abstract

The hugely popular Indonesian pastime of keeping wild-birds for pets is threatening the long-term survival of many song-bird species on the Islands of Java and Bali. Here, we present the results of a large-scale household survey of bird-keeping in the six largest cites of Java and Bali that investigates: 1) the scale and conservation significance of bird-keeping and; 2) the relative merits of regulatory versus market-based approaches as means to reduce the enormous demand for wild-caught birds.

We found bird-keeping is widespread across social groups, with evidence of a rising demand for certain species of conservation importance. Specifically, 35.7% of households surveyed keep a bird and 57.6% of households had kept a bird in the last ten years. The songbird category of birds is the most important from a conservation perspective because it comprises large numbers of wild caught birds. Overall, we projected that 584,000 households keep almost 2 million songbirds. The most popular species kept was canary *Serinus canarius*. Just over half of songbirds kept are wild caught and we identified a major increase in popularity of three native species with superb song repertoire compared with our 1999 survey. These are long-tailed shrike *Lanius schach*, orange-headed thrush *Zoothera citrina* and white-rumped shama *Copsychus malabaricus* and all had projected captive populations in excess of 100,000.

This increase in consumer demand is attributed to their rising popularity in bird song contests. In the case of the latter two species it has caused 'rolling' local extinctions across West Indonesia.

Given its huge popularity and deep cultural significance of bird-keeping we argue that a regulatory 'laws and fines' approach would be both undesirable and impractical. Furthermore this approach might alienate a potential future supporter base for bird conservation NGOs operating in Indonesia. We therefore favour a portfolio of 'softer' policy instruments that might include market-based and voluntary mechanisms and engage a wider range of actors in the governance of bird-keeping in Java and Bali.

Keywords

Environmental governance, Indonesia, wildlife trade, pet-keeping, CITES

Introduction

The renowned naturalist Edward O. Wilson has proposed that humans are characterised by a deep affiliation with the natural world that is rooted in our biology (Wilson 1984). One of the most obvious manifestations of these 'biophilic' attractions and positive feelings is the widespread practice of keeping pets for companionship or as objects of intrinsic beauty, curiosity and/or prestige (Erikson 1997; Drews 2001). This social practice is a double-edged sword for the global conservation movement. On the positive side pet-keeping can be considered as one of the most important ways of promoting interest and respect for the non-human world and, unlike zoological parks, allows intimate interactions with strong psychological and social benefits. Put in another way, affection and admiration for pets may also promote positive attitudes towards the continued protection of wild animals in their natural habitats.

Unfortunately, pet-keeping can also generate threats to populations of wild species. For example, recent mathematical models suggest that domestic cats (*Felis catus*) in the UK may cause decreases of urban songbird abundance of up to 90% (Beckerman et al 2007). More relevant to the present study, consumer demand for pets taken from the wild can promote unsustainable supply chains in wildlife in countries and regions that are poorly regulated. For example, the global trade in ornamental fishes was estimated in the mid-1990s to involve approximately 350 million fish annually with a combined value of over US$900 million (Young 1997 cited in Tissot & Hallacher 2003). Although the headline figures may be less startling for other vertebrate groups the conservation significance of the pet trade is well recognised, especially if the rarity value of a species captures the attention of "collectors" in the west. The Spix's Macaw *Cyanopsitta spixii* and Bali Starling *Leucopsar rothschildi* are two infamous examples of

specialist demand driving the ecological extinction of species (Juniper, 2002, Sodhi et al 2004).

International trade in species has been well studied and has an established regulatory regime founded on the Convention on Trade in Endangered Species (CITES) employing a combination of laws, quotas, fines, trade bans, trade monitoring protocols and organization capacity building (Oldfield, 2003). In contrast, practices of pet-keeping and trade that operate within national boundaries are poorly known and governed. Where information is available the conservation implications of pet-keeping appear considerable For example, a survey of pet keeping habits in Costa Rica found that 24% of households kept wild species as pets and that parrots were the most common wild-caught pet (Drews 2001). In similar survey in Indonesia, Jepson & Ladle (2005) reported that birds are urban Indonesia's most popular pet and 60.2% bird-keeping households kept a wild bird. Based on the ubiquity of the pastime they suggested that a non-state market-based policy instruments (cf Cashore, 2002) might be more effective than extending the international regulation and enforcement approach into the Indonesian domestic arena.

In response to this initial study we initiated a major applied research project to create a stronger evidence base from which to assess and develop alternative policy options aimed at reducing the negative conservation impacts of bird-keeping in Indonesia. The research was conducted by a partnership involving the Oxford University Centre for the Environment, the market research company Nielsen a conservation group, Burung (formerly BirdLife) Indonesia and the bird keeper association Pelestari Burung Indonesia (PBI). Key features of this research include: 1) the generation of a more extensive and detailed evidence-base on the socio-demographics of bird-keeping, 2) the

employment of social marketing frameworks and social science techniques to generate a detailed understanding of the relationship between consumers, wildlife and policy instruments (see e.g. Kotler & Roberto, 1989) and; 3) the desire to explore the notion of third generation governance mechanisms whereby the willing cooperation of those subject to governance, in our case bird-keepers, is enlisted (Durant *et al.*, 2004);

The present paper is the first in a series that will discuss the findings of this research. Here we present: 1) a conservation survey tool for large-scale social surveys of public attitudes and practices adapted from Neilson's household consumer surveys; and 2) the results from the application of this tool to bird-keeping habits in six major cities of Java and Bali. We report spatial, temporal and cultural characteristics of bird-keeping within these cities including numbers, ethnicity and socio-economic attributes of bird-keepers, the species kept, the projected numbers of each species and the proportions of wild-caught and captive-bred birds. Where possible, we compare the results of the current survey with our earlier (1999) survey to identify general trends and dynamics in the pastime. We then discuss the results in the context of the relationship between bird-keeping and various socio-economic demographic attributes of the urban population to provide a more nuanced understanding of the objects (the species of concern) and targets (the individuals whose behaviours we seek to change) of conservation governance. Finally, we discuss the implications of the expanded evidence base for the development of new governance mechanisms.

Methods

The six cities surveyed were selected on the basis of: a) being included in the Nielsen Omnibus[TM] survey and for which we had existing data (4 cities: Jakarta and Bandung in

West Java, Semarang in Central Java and Surabaya in East Java); and b) being large cities and known centres of bird keeping with distinct cultural heritages (Yogyakarta in Central Java and Denpasar in south Bali).

Questionnaire development and piloting

We adopted a face-to-face questionnaire survey of a random sample of 1781 households in the six largest cities on Java and Bali. Face-to-face surveys were deemed necessary since they support longer and more complex question sets. A random sample permitted the application of robust statistical tests and projection of results to the urban population of these cities. The six-city sample ensured adequate sampling of geographic and cultural variation.

The questionnaire was comprised of two sections: a group of question sets asked of all households and an additional group asked of only songbird-keeping households. A set of three initial filter questions: 1) excluded people employed in the media, advertising and research industries; 2) assured that they had not been interviewed on the topic in the last six months; and 3) asked to interview the person who made decisions about bird-keeping in the household. The first section, asked of the total sample population, consisted of three question sets: 1) Nielsen Indonesia's standard socio-economic attribute and media habit questions; 2) pet keeping history, including birds; 3) general attitudes to birds, nature and conservation. The well validated and long established Nielsen methodology asks respondents to assign themselves to the following: i) their position in the household (8 categories); ii) main occupation (15 categories) ; highest educational qualification (9 categories); iv) monthly household income and expenditure (27 categories). The second section, asked of songbird keepers only, involved a further four question sets covering; 4) motivations for keeping birds; 5) detailed information on birds kept (species, numbers, where sourced, value etc.); 6) attitudes to certification and captive birds; and 7) media consumption habits. Results of question sets 4, 6 & 7 are not reported here.

The questions were developed over an eight-month period (Sept 2005 - May 2006) and informed by a range of preparatory qualitative research work. This included: a) in-depth interviews with seven bird-breeders and hobbyists in West and Central Java

(September 2005); b) informal interviews with over 20 participants at a regional song contest in Surabaya (January 2005); c) three focus groups with a total of 30 bird keepers held in Bogor and Jakarta (February, 2006); d) interviews with owners of four kiosks selling birds and bird-keeping equipment in west Java (April 2006); e) an analysis of the weekly bird-keeping newspaper 'Agrobis Burung' (March 2005 – March 2006); f) a review of the representations of 'nature' in popular magazines on pets, gardening and small-holding; and g) a review of questions used in two previous Omnibus^{TM} surveys conducted in June 1999 (Jepson & Ladle, 2005) and November 2005 (unpublished).

The questionnaire was initially developed in the English language. A final draft was translated into the Indonesian language by the Burung (BirdLife) Indonesia team. The Indonesian draft was piloted with 40 respondents in Bogor in May 2006 and final refinements were made during field training of enumerator team leaders.

Sampling Frame

We adapted the Nielsen Indonesia Omnibus^{TM} survey sample frame, which randomly surveys approximately 400 households in Jakarta and 300 in other cities. Data from June 1999 (Jepson & Ladle, 2005) and November 2005 (unpublished) Omnibus^{TM} surveys placed incidence levels of bird-keeping households at between 10% (Jakarta) and 30% (Bandung). Based on this incidence rate, it would not be possible to produce valid projections for some variables, yet enlarging the 'base' sample would produce an unfeasibly large number of sample households. To overcome this problem we added a 'booster sample' of bird-keeping households to meet a desired quota of 75 bird-keeping respondents per city, giving a total sample of 450 songbird-keeping households.

Following Nielsen methodology, the 'base' sample was generated using the Indonesian administrative divisions of neighbourhoods (*Rukun Tertangga)*, which normally contain 50 households. Official lists of neighbourhoods, which are numbered, were obtained from every *kelurahan* (village) in each city. Neighbourhoods were stratified geographically. Thirty neighbourhoods per city were selected randomly from the stratified list, with ten respondents (households) sampled in each.

The protocol for choosing households within in an neighbourhoods was as follows: 1) The house of the neighbourhood head (*ketua RT*) was identified and permission sought

to survey households in that neighbourhood; 2) If permission was denied, enumerators moved to the neighbourhoods numbered one higher; 3) Where permission was granted, enumerators began sampling at the first to fourth house (randomly selected beforehand) on the left of the neighbourhood head's house; 4) The enumerator then sampled every third house counting only residential buildings on the left-side of the road. Each time they met a road junction they turned left; 5) If the household did not meet the criteria for inclusion in the survey (see below) the enumerator moved to the next third house. If the enumerator was unable to interview an appropriate respondent from a household after three visits, the enumerator added a replacement household following the same sampling protocol; 6) If the enumerator had sampled the entire neighbourhoods and not achieved ten respondents, the survey was extended along the road into the neighbouring neighbourhood.

For the purpose of the survey, a household was defined as an economically discrete social unit whose occupants cooked together. Individuals living in rented rooms were excluded. Thus, a household did not necessarily equate to a building. To prevent over-representation of households from barrack-type (army and civil service) accommodation, a maximum of three households units were sample from each complex. For a non-bird-keeping household, the respondent was the head of the household or, in their absence, another adult who could answer questions on household socio-attributes. For songbird-keeping households the respondent had to be the person that made decisions about bird-keeping in the household (to exclude children and household help).

The booster sample was generated by counting the songbird-keepers in the randomized neighbourhood sample (above) and then calculating the number of additional respondents required to achieve our desired sample size of 75 bird-keeping households per city. The number of additional neighbourhoods in which the booster respondents were to be found was calculated by dividing the booster sample needed per city by the average frequency of bird-keepers in the randomized neighbourhood sample. This generated a number of new neighbourhood to be sampled together with a target number of songbird-keeping households to survey within each. Following this method, cities with a low frequency of songbird-keeping households would require a large booster sample and prohibitive number of additional neighbourhoods to be sampled. To overcome this,

an arbitrary number of ten additional neighbourhoods was set. Booster neighbourhoods were selected on the basis that they: a) represented the geographic spread of the city; and b) were not located in a city sub-district that had been previously surveyed. Songbird-keepers were located through observation and enquiry.

Survey Administration

Questionnaires were administered in an informal setting in the respondent's house. Enumerators were trained to ensure that other members of the household did not contribute. Permission to implement the survey was sought by the team leader directly from the neighbourhood head, using a letter prepared for the purpose by Burung Indonesia and PBI. Where the neighbourhood head requested, permission was sought from the head of the sub-district (the next highest administrative division).

Two survey teams were established, in each city. The 12 team leaders underwent a 3-day training course at Nielsen's dedicated training centre, covering project objectives and survey team management in addition to field tests and implementation of the questionnaire. Each team leader recruited a team of 4-6 enumerators who were then trained by the team leader and Burung Indonesia project supervisor.

Implementation of the survey took between 2 and 6 weeks in June-July 2006, depending on the time availability of enumerators, the size of the city, and receptivity of respondents. During the surveys, teams regularly met to resolve arising issues. Quality and integrity of questionnaire data was assured by the team leader: 1) observing the administration of the first questionnaire by each enumerator, and continuing to do so until satisfied that the enumerator was competent to work alone; and 2) undertaking a 'recall' of 30% of the total questionnaires submitted by each enumerator throughout the survey period. Recall involved contacting the respondent by phone or visiting to confirm that they had been interviewed and checking consistency of answers by repeating 3-5 randomly selected questions. Questionnaires directly observed during the 'witnessing' were counted towards the 30% recall quota.

Data management and analysis

All questionnaires received by Burung Indonesia were given a unique code number and checked for completeness and consistency of answers to key questions. Data input into Excel spreadsheets was carried out in the Burung Indonesia offices by a team of six volunteers recruited specifically for the task. The data entry teams worked in 4-hour shifts to avoid mistakes due to tiredness. As a safeguard against data entry errors, ten percent of questionnaires processed by each volunteer were re-checked by an independent team.

We classed respondents into hobbyist and pet bird-keepers. Hobbyists were defined on the basis of showing a bird at a song contest. To minimize the variance on our projections, we calculated the average number of birds per bird-keeping household from the dedicated survey, i.e. songbird-keeping households within the random sample plus all booster sample households (n=454).

Projections

Due to the rigorous and representative nature of the sample it was possible to make accurate projections of both the number of bird-keeping and songbird-keeping households for the study populations and, more cautiously, the total number of songbirds of different species currently in captivity in these cities. To render these projections more useful for policy and conservation purposes, 95% confidence limits were calculated assuming a Poisson distribution. The projected total population size of captive songbirds in the six cities was calculated by multiplying the projected number of songbird-keeping households (random sample) by the mean number of songbirds per songbird-keeper (random plus booster sample). Population estimates for individual species were calculated by multiplying the total captive songbird number by the frequency of each species in the whole sample (random plus booster).

Results

Incidence of bird-keeping

The survey found that birds were the most popular pet with more than 1-in-3 households keeping a bird in the six cities surveyed. Fish were the next most popular pet, followed

by cats, dogs, small mammals, livestock, reptiles and monkeys (Figure 1a). Of households currently keeping different bird-types, dove was the most popular category followed by songbird, show-chickens, pigeon and 'exotics' (high value rarely kept species favoured by collectors, such as macaws *Ara spp*., green peafowl *Pavo muticus* and hill myna *Gracula religiosa*) (Figure 1b). Within our sample population 57.6% (1025/1781) of households had kept a bird previously (last 10yrs) and 27.7% (494/1781) had kept a songbird. There were significant differences in the proportions of households in the sample population keeping birds in different cities (Table 1).

<<TABLE 1 here>>

Of the households surveyed, 20% (357/1781) had ceased to keep birds within the last ten years, and of those who reported year the stopped, 66.9% (234/350) ceased bird-keeping within three years of obtaining a bird. During the years 2000 to 2006, the percentage of households giving up birds was between 1.8% (2004) and 2.5% (2000) with the exception of 2005 (the year of bird flu scares) when the rate of giving-up doubled to 4.4%.

Numbers of birds

The projected number of households across the six cities keeping a bird (excluding chicken) was 1,451,803 (95% CIs 1,188,812-1,747,554). Jakarta and Surabaya held the highest number of bird-keeping households (Table 2a). Based on the mean number of songbirds kept per songbird-keeper (random plus booster sample) and stratified by city, the projected number of songbirds kept throughout the six cities was 2,157,754 (Table 2b).

<<Table 2 here>>

According to the dedicated survey, of this total number of songbirds kept, 31.9% were domestic species, 58.5% (approximately 1 million birds) were wild-caught species, 1.6% were species that are now mostly captive-bred and 8.1% were species for which some captive breeding occurs. The figures for the wild-caught category were then further sub-divided into wild-caught native species (94.9%) and wild-caught imported species,

mostly from China (5.1%). These latter two figures are not comparable to those reported for these categories in Jepson & Ladle (2005).

Restricting analysis to the four Javan cities common to both surveys allowed further investigation of the data. Applying the same methods of projection (average number birds kept per household in the random sample), we discovered that the number of wild-caught native songbirds kept has increased (projection = 738,518 in 1999 c.f. 1,086,692 in 2006) while the number of wild-caught imported songbirds has substantially decreased (projection = 189,210 in 1996 c.f. 58,400 in 2006). Furthermore, for five popular songbird species, we found a strong and consistent pattern of increasing ownership (Table 3).

Thirty-five bird species were recorded in the survey, of which 29 were included in the analysis (n ≥ 5). In terms of numbers and proportion of households the most popular songbird species kept was canary *Serinus canarius*, followed by three native species: long-tailed shrike *Lanius schach,* orange-headed thrush *Zoothera citrina*, and white-rumped shama *Copsychus malabaricus*. These, together with two 'common garden' bulbuls *Pycnonotus* spp., exhibited projected captive populations in the six cities in excess of 100,000 birds. Five further species displayed projected captive populations greater than 50,000, of which three: lovebird *Agapornis* spp., budgerigar *Melopsittacus undulatus*, and java sparrow, are captive-bred in Java (see Table 4, Table 5).

The projected number and proportion of bird species listed on CITES Appendices I & II (straw-headed bulbul *Pycnonotus zeylanicus*, java sparrow *Padda oryzivora* and hill myna *Gracula religiosa*) was 100,003 (5.4%) and 50,001 (2.7%) if java sparrow, which is commonly bred, was excluded. The comparable figures for species classed as threatened by BirdLife International (2001) (species as above with the addition of lory *Lorius* spp.) were 105,558 (5.7%), or 55,557 (3.0%) if java sparrow was excluded, and for those protected under Indonesian law (java sparrow and black-shouldered starling) were 61,111 (3.3%). No songbird-keepers surveyed currently kept a cockatoo *Cacatua* species, which are included in all of the above three categories.

Comparison of the incidence of keeping of certain key species with our earlier survey (n=1740) (Jepson & Ladle, 2005) revealed some marked increases for some species of conservation concern In the 1999 survey, orange-headed thrush was

only detected in 3 households (all in Bandung) whereas in this 2006 survey it was detected in 14 households across Bandung, Surabaya and Semerang (four Javan cities, random sample); long-tailed shrike was detected in one household in Surabaya in 1999 but in 38 households and all four cities, though predominately in Surabaya and Semerang, in 2006; white-rumped shama was detected in 13 households in 1996 but appeared in 25 households in 2006. Leafbird *Chloropsis* spp. was undetected in 1999 but found in 12 households in Surabaya, Semerang and Bandung in 2006. Straw-headed bulbul was detected in 11 households in 1999 and 10 in 2006.

<<Table 4 here>>

Socio-demographic associations

Our sample included seven distinct ethnicities, although three of these accounted for 83.5% of the sample population: Javanese (54.8%), Sundanese (16.2%) and Balinese (12.5%). Restricting our analysis to these three ethnicities, we found a significant difference in the incidence of bird-keeping (χ^2 = 41.093, df=2, P<0.001) and of keeping doves (χ^2 = 11.065, df=2, P=0.003), zebra doves (χ^2 = 32.75, df=2, P<.001), songbirds (χ^2 = 8.68, df=2, P=0.013) and chickens (χ^2 = 37.001, df=2, P<0.001). In all these cases, the incidence of keeping was highest among the Balinese and lowest by the Sundanese. Songbird-keeping showed the least differentiation between Balinese and Javanese populations.

Household income was not significantly associated with bird-keeping or category of bird kept. An exception to this general pattern occurred with chicken-keeping, where lower income group (C&D) households were more likely to keep a chicken (χ^2 = 14.029, df=4, P=0.007). The head of household's occupational type was significantly associated with bird-keeping (χ^2 = 11.15, df=3, P=0.011) in general as well as, more specifically, the owning of doves (χ^2 = 8.61, df=3, P=0.035) and songbirds (χ^2 = 13.13, df=3, P=0.004). Blue collar and non-workers were more likely to keep a bird with blue-collar workers more likely to keep a songbird and non-workers showing most preference for doves.

We found a weak but significant association between educational level and bird-keeping (χ^2 = 9.63, df=4, P=0.022) with respondents in possession of a diploma or degree being less likely to own a bird. However we found no association between education and

the categories of birds kept. The two oldest age categories displayed the highest incidence of bird-keeping, but the youngest age group (<25) kept more birds. Pigeons were more likely to be owned by those under 25 years of age (Table 6).

<<Insert Table 6 here>>

Based on the dedicated survey, we found significant associations between certain socio-demographic attributes and ownership of the eight commonest species of songbirds kept. More than twice as many Sundanese kept a canary than any other ethnicity (χ^2 = 52.56, df=2, P<0.001). Higher education categories were more likely to keep a canary (χ^2 = 9.88, df=3, P=0.002) while blue-collar workers were less likely to keep this type of bird than other employment categories (χ^2 = 14.69, df=3, P=0.002).

Orange-headed thrush was more common in Sundanese households (χ^2 = 12.95, df=2, P=0.002), and the incidence of keeping this thrush displayed a consistent pattern of increase from the lowest income category, E, (5.7%) to the highest income category, A, (20.0%) (χ^2 = 10.01, df=4, P=0.04). Entrepreneurial and white-collar workers appeared more likely to keep an orange-headed thrush (χ^2 = 13.13, df=3, P=0.004) while this bird species is less commonly kept by individuals who have not completed high-school (χ^2 = 8.24, df=3, P=0.041).

Long-tailed shrike was more popular with Javanese (χ^2 = 6.43, df=2, P=0.004), and much less likely to be kept by non-workers (χ^2 = 11.91, df=3, P=0.008). White-rumped shama proved unpopular with Balinese (χ^2 = 13.25, df=2, P=0.001) and was more likely to be owned by income categories A-C (χ^2 = 11.61, df=4, P=0.02). Magpie robin *Copsychus* spp. was predominantly owned by those within the 36-45 year old age category (χ^2 = 12.49, df=4, P=0.014) and more highly educated people (χ^2 = 9.29, df=3, P=0.026).

Yellow-vented bulbul *Pycnonotus goiaver* was more commonly kept by the Sundanese (χ^2 = 17.09, df=2, P<0.001); people of this ethnicity were also much more likely to own a captive-bred bird (65.8% keeping a captive-bred bird, butcanaries are popular with this group) (χ^2 = 30.38, df=2, P>0.000). We found no associations between Leafbird or Yellow-vented Bulbul ownership and socio-demographic categories, but Sooty-headed Bulbul *Pycnonotus aurigaster* demonstrated a consistent association with

education attainment level: from university graduates (11.3% ownership) to primary school education or less (30.5% ownership) (χ^2 = 10.27, df=3, P=0.016).

Discussion

Dedicated surveys of consumers offer a valuable additional conservation tool to assess and monitor human impacts on wild animal populations. Omnibus^{TM} surveys, such as the one employed in our previous study (Jepson & Ladle, 2005), are suitable for measuring broad-categories (e.g. bird-type) or common activities in the population (e.g. shopping or voting preferences) but are not as suitable for detecting less common activities and/or commodities. In many developing countries assessing, the status of species in situ is difficult due to the challenges of recruiting and/or training field ecologists, the reliability of statistical extrapolations and logistical issues. To date, market-surveys of species have been the principle means of assessing the impact of trade but data from such surveys cannot be projected or compared since it is not possible to standardize sampling. In contrast, consumer surveys can be designed following tested principles and protocols, enumerators can be trained easily, data can be verified and the survey can be administered within a fixed time and to a designated schedule. In addition, consumer surveys can be designed to generate data that can inform and design policy and social change strategies. Moreover consumer surveys are relatively inexpensive - the survey reported here cost c.€10,000 to administer, including data entry and checking. The questionnaire development, design and basic analysis were more expensive (because of the involvement of western-located conservationists) but did not exceed €12,000. As such surveys become more commonly used, and as common questions, standard question sets and analytical techniques emerge, these latter costs might fall.

Implications for Conservation Governance

Indonesia currently relies on a traditional state-led 'law-and-fine' approach to regulating the trade or harvest of species. Species recognized by the state as being threatened due to exploitation or other factors are included on Indonesia's list of protected species; it is an offence to harvest, own or trade these species and the government is responsible for identifying and prosecuting offenders (RI 1999). Bird conservation organisations play an

important role in this process by identifying threatened species and lobbying for their inclusion on the list.

It is clear that some species are very widely kept, and that this is causing conservation impacts. Indeed the data reported herein may go some way to explaining the marked decline in wild bird populations observed over the last 50 years (Holmes, 1995). From our list of the 29 most commonly owned species (Table 4), only three have any form of regulatory protection (2 CITES Appendix II, and 2 IUCN Red List, 2 Indonesian protected species). A further 4 species, listed under 'other' and re-classified as 'exotics' were endangered and/or protected species. Based on this finding, it might be surmised that bird-keeping is not a serious conservation issue. However, we argue that these figures merely expose the time lag between the emergence of threats to wild species and the subsequent codification of this into relevant frameworks and legislation.

A comparison between this present investigation and our 1999 survey indicates that the number of native songbirds kept is increasing and the number of imported songbirds (mainly *Garrulax* and *Lirhtorix spp*. from China) has substantially decreased. This can be partly explained by the sharp rises in price of imported songbirds following the collapse of the Indonesia rupiah in 1997, closely followed by Indonesia banning the importation of Chinese songbirds in 2001 due to concerns over avian flu. Importantly, the keeping of native species with exceptional vocal capacities (the two *Zoothera* thrushes, long-tailed shrike, white-rumped shama, magpie robin and leafbirds spp.) appears to have increased dramatically in the last five to ten years. These are principally territorial species with correspondingly limited populations; consequently the scale of exploitation suggests significant negative impacts on wild populations. In Indonesia, the straw-headed bulbul, a traditional favourite, is already virtually extinct in the wild due to high bird-keeper demand (BirdLife International 2001). The hobbyist newspaper editor and bird-breeders interviewed believed that wild populations of several species have been decimated in the last 5 years as a direct result of their rise in popularity amongst the bird-keeping fraternity. In the case of orange-headed and chestnut-headed thrushes *Zoothera citrine* and *Zoothera interpres*, the newspaper editor recounted how each forest block in Java was systematically 'caught out' by 2003 or 2004. Java was an important population centre for both species, each of which was relatively common. Orange-headed thrush has

a wide but disjunct distribution in Asia and is rare outside Java and Bali, while the chestnut-headed thrush occupies a more restricted distribution from East Java into the Lesser Sundas (Hoyo *et al*., 2005).

It appears that white-rumped shama was 'caught out' from Java prior to 1997, but the fall of the Suharto regime in 1998 and the subsequent rise of 'wild-logging' and agricultural encroachment in Sumatra and Kalimantan has created new supplies of wild-caught birds. To our knowledge, this has decimated populations in southwest and northern Sumatra (Nick Brickle, Chris Shephard pers. comm.) in addition to West Kalimantan (Yuyun Kurniawan, pers. comm.), and this pattern may be repeated across western Indonesia.

The data suggests that market demand for species in Java and Bali is dynamic and influenced by fashions in songbird contests, broader social economic trends and legislation. This poses a significant challenge to legislation-based instruments, namely remaining responsive to variation in market demand (regulator lag) while avoiding shifting the focus of exploitation from one species to another. For instance adding Orange-headed thrush to a protected species list might simply generate more interest in currently less popular song contest species such as leafbirds thereby displacing rather than solving the conservation problem.

Law and enforcement approaches could be expected to be more effective when the legislation targets a small or specific group within the population (e.g. criminals) or intuitively makes some sense on safety, moral or other grounds (e.g. driving whilst using a mobile phone). Our finding that two thirds of urban households have kept a bird in the last 10 years, and that bird-keeping is not strongly correlated with any age, income, professional or ethnic group, underlines the ubiquitous nature and cultural 'embeddedness' of the pastime and suggests that tighter regulation would be opposed by public opinion and receive little support from government enforcement bodies, not least because many officials are themselves bird-keepers. Furthermore, the practice of bird-keeping, and in particular competing song birds, brings together people from all social backgrounds in a common interest. The observation that the hobby may be a valuable cultural asset in terms of promoting social harmony and cross-ethnic communication in

Java's potentially volatile urban populations, further illustrates the 'bluntness' of the protected species regulatory instrument.

Our finding that the pattern of bird-keeping (incidence and species) differs between illustrates the potential value of this cultural asset in terms of creating city identities. The degree to which these patterns are determined by ethnicity (culture), traditions in the city and/or the biogeographic location of a city is difficult to tease out from the data presented. Of the six cities surveyed, the bird-keeping profile of Denpasar may be the one most obviously influenced by cultural heritage; the popularity of chicken-keeping in Denpasar could be attributed to the important role that the cock-fights once played in Balinese village life. A second highly 'distinctive' city is Bandung, on account of the popularity of Canary ownership. Canaries are also popular in the city of Malang in East Java (not surveyed) (e-group Forum Kenari Mania pers. comm.). This is probably because being at higher altitudes (768m and ca.600m a.s.l. respectively) the cooler climate of these cities is more suited to the canary. This native of a temperate island does not breed easily in lowland Jakarta, and Indonesia's first canary breeding (ca. 30 years ago) is believed have been in Bandung (Forum Kenari-Mania, pers. comm.). More generally, the pattern of species kept appears to have some relationship to the ecological context of the city. For instance, long-tailed shrike is more popular in the cities of East Java. This open-country predatory species is more abundant in the dryer landscapes of East Java compared to the wetter, lusher landscapes of the west of Java (S. van Balen, pers. comm.).

Bird-keeping therefore appears to reflect and be part of the cultural, technological, and ecological heritage of a city, something that policy-makers may want to promote rather than legislate against. This line of argument could be extended to include bird conservation NGOs. Organisations such as Burung (BirdLife) Indonesia are actively seeking to build local membership in order to maintain the legitimacy of their policy voice and generate sustainable funding streams. This membership is likely to come from the urban middle class and from individuals who appreciate birds. As we have shown, an enjoyment of birds in Java and Bali translates into keeping cage-birds; antagonising this potential constituency by campaigning for stricter legislation may in fact be counterproductive.

Conclusion

All this considered we favour the development of 'softer' policy instruments that might include market-based and voluntary mechanisms to engage a wider range of actors in the governance of bird-keeping in Java and Bali. A policy instrument combining an expansion of bird breeding and certification of breeders, the promotion of captive bred bird 'classes' at songbird contests and a social marketing campaign is in an advanced state of development (Jepson & Ladle forthcoming). This does not exclude a role for law and enforcement. A high proportion of households in our survey were 'dabblers' who tried bird-keeping for a short time. The threat of sanction coupled with a social marketing campaign could persuade such people to either avoid starting or to give-up bird-keeping as a hobby. What is needed is a blend of old and new policy instruments.

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Table 1 Proportions of households keeping birds in 2006 and at some time in the previous ten-years in six cities on Java & Bali. C = currently owned, P = current plus previously owned.

Type	Time Frame	Jakarta(n=293)	Bandung (n=299)	Yogyakarta (n=300)	Semerang (n=299)	Surabaya (n=290)	Denpasar (n=300)	χ^2	P
Dove	C	8.2% (24)	11.0% (33)	15% (45)	16.4% (49)	16.6% (48)	27.7 %(83)	49.86	<0.001
	P	17.7% (52)	19.1% (57)	26.7% (80)	31.1% (93)	28.6% (83)	39.3% (118)	48.25	<0.001
Songbird	C	8.9% (26)	8.4% (25)	14.7% (44)	19.1% (57)	20.0% (58)	17.3% (52)	28.77	<0.001
	P	19.5% (57)	18.7% (56)	34.7 (104)	34.8% (104)	31.7% (92)	27.0% (81)	39.11	<0.001
Chicken	C	12/3% (36)	6.7% (20)	12.0% (36)	9.7% (29)	9.7 (28)	20.7% (62)	32.68	<0.001
	P	25.3% (74)	19.1% (57)	28.0% (84)	21.7% (65)	17.6% (51)	26.3% (79)	14.63	0.012
Pigeon	C	2.0% (6)	5.7% (17)	5.3% (16)	2.3% (7)	6.2% (18)	1.0 (3)	20.25	0.001
	P	5.8% (17)	15.1% (45)	12.7% (38)	12.4 (37)	11.7% (34)	3.7 (11)	32.07	<0.001
Exotic	C	0.3% (1)	0.3% (1)	0.3% (1)	0.7% (2)	0.7% (2)	1.7% (5)		
	P	0.7% (2)	0.7% (2)	1.3% (4/300)	1.7% (5)	1.0 (3)	2.3% (7)		
All	C	25.3% (74)	25.4% (76)	35.8% (107)	38.4 (113)	40.6% (117)	48.2% (144)	51.97	<0.001
	P	50.2% (147)	49.5% (148)	59.0% (177)	62.9% (188)	60.0% (174)	63.7% (191)	23.50	<0.001

Note: Figures calculated from random household survey (n= 1781). Numbers of 'exotics' were too low for statistical analysis.

Table 2 Projected number of households in six cities on Java & Bali a) keeping birds and b) keeping songbirds only. Projected number of songbirds based on an average of 3.698 songbirds per songbird-keeper (random plus booster sample). *Number of households from Nielsen Indonesia data.

a)

City	Households*	Freq. Bird-keeping households	95% CI Lower	95% CI Higher	Projected no. bird-keeping households	95% CI Lower	95% CI Higher
Jakarata	2,528,000	0.259	0.198	0.317	638,471	501,327	801,536
Bandung	681,000	0.264	0.200	0.318	173,097	136,383	216,648
Yogyakarta	146,000	0.363	0.302	0.411	52,073	44,159	59,987
Semerang	443,000	0.397	0.323	0.433	167,421	143,074	191,769
Surabaya	818,000	0.406	0.347	0.460	330,021	283,833	376,209
Denpasar	189,000	0.482	0.423	0.537	90,720	80,035	101,405
Total	**4,805,000**				**1,451,803**	**1,188,812**	**1,747,554**

b)

City	Freq. songbird-keeping households	95% CI Lower	95% CI Higher	Projected no. songbird-keeping households	95% CI Lower	95% CI Higher	Projected number of songbirds kept	95% CI Lower	95% CI Higher
Jakarata	0.089	0.057	0.131	224,328	145,162	331,152	829,564	536,811	1,224,602
Bandung	0.084	0.054	0.123	56,940	36,846	84,055	210,563	136,256	310,834
Yogyakarta	0.147	0.107	0.197	24,413	15,559	28,747	79,187	57,537	106,308
Semerang	0.191	0.144	0.247	84,452	63,694	109,415	312,302	236,537	404,618
Surabaya	0.20	0.152	0.259	163,600	124,221	211,486	604,993	459,371	782,074
Denpasar	0.173	0.129	0.227	32,760	24,465	42,961	121,146	90,472	158,871
Total				**583,492**	**410,217**	**807,817**	**2,157,754**	**1,516,984**	**2,987,307**

Table 3. Comparison of incidence of households keeping songbird species competed in bird song contests between 1999 and 2006 in four cities on Java and Bali.

	Jakarta		Bandung		Semarang		Surabaya	
Date of survey no. households	1999 (n=520)	2006 (n=293)	1999 (n=309)	2006 (n=299)	1999 (n=305)	2006 (n=299)	1999 (n=302)	2006 (n=290)
Proportion keeping	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	c (%)	n (%)
Long-tailed shrike	0	3 (1.0)	0	1 (0.3)	0	15 (5.0)	1 (0.3)	19 (6.6)
Orange-headed thrush	0	0	3 (1.0)	4 (1.3)	0	5 (1.7)	0	5 (1.7)
White-rumped shama	2 (0.4)	3 (1.0)	2 (0.6)	6 (2.0)	7 (2.3)	10 (3.3)	2 (0.7)	6 (2.1)
Magpie robin	0	0	0	1 (0.3)	5 (1.6)	12 (4.0)	5 (1.7)	5 (1.7)
Leafbird spp.	0	0	0	3 (1.0)	0	4 (1.3)	0	5 (1.7)

Note figures from random households surveys

Table 4 Numbers of bird species kept by songbird-keepers in six cities on Java & Bali, ranked in order of popularity (random + dedicated sample)Table 6

Species[1]	Common name	Threat Status[1]	Breeding Status[2]	Song-Contest[3]	No. bird-keeping households	Actual no. of birds	Projected no of birds	95% CI Lower	95% CI Higher
Serinus canarius	Canary		D	**	125	382	493,570	346,999	683,324
Lanius schach	Long-tailed shrike		W	***	108	154	198,979	139,890	275,476
Zoothera citrine	Orange-headed thrush		W	***	63	138	178,305	125,356	246,855
Pycnonotus goiaver	Yellow-vented bulbul		W		109	137	177,013	124,447	245,067
Pycnonotus aurigaster	Sooty-headed bulbul		W		102	132	170,553	119,905	236,122
Copsychus malabaricus	White-rumped shama		S	***	68	94	121,454	85,387	168,148
Copsychus saularis	Magpie robin		W	**	63	77	99,489	69,945	137,738
Agapornis spp.	Lovebird		D	*	30	60	77,524	54,502	107,328
Chloropsis spp	Leafbird spp.		W	**	49	56	72,356	50,869	100,173
Melopsittacus undulatus	Budgerigar		D		18	46	59,435	41,785	82,285
Padda oryzivora	Java sparrow	II/VU	M		12	45	58,143	40,877	80,496
Acridotheres javanicus	White-vented myna		W		33	42	54,267	38,152	75,130
Orthotomus sutoris	Common Tailorbird		W		25	39	50,391	35,427	69,763
Mirafra javanica	Singing Bush-lark		W	**	21	34	43,930	30,885	60,819
Prinia familiaris	Bar-winged prinia		W		17	33	42,638	29,976	59,031
Zoothera interpres	Chestnut-headed thrush		W	**	18	32	41,346	29,068	57,242
Criniger bres	Puff-throated bulbul		W	M	25	30	38,762	27,251	53,664
Cyornis spp.	Blue flycatcher		W	*	20	22	28,426	19,984	39,354
Pycnonotus zeylanicus	Straw-headed bulbul	II/VU	M	**	15	21	27,133	19,076	37,565
Sturnus contra	Pied starling		M	M	11	15	19,381	13,626	26,832
Garrulax	Hwa mei		W	**	8	15	19,381	13,626	26,832
Zosterops spp.	White-eye		W		7	14	18,089	12,717	25,043
Lonchura spp.	Munia		W		7	13	16,797	11,809	23,254
Oriolus chinensis	Black-naped oriole		W		10	10	12,921	9,084	17,888
Garrulax chinesis	Blk-throated laughing thrush		W	**	10	10	12,921	9,084	17,888
S. melanopterus	Black-shouldered starling		S		9	10	12,921	9,084	17,888
Saxicola caprata	Pied stonechat		W	***	3	5	6,460	4,542	8,944
Leothrix	Red-billed leothrix		W		2	2	2,584	1,817	3,578
Ploeceus spp.	Weaver		W		2	2	2,584	1,817	3,578

Table 5 Proportions of songbird keeping households in six cities on Java & Bali keeping the eight most common songbird species.

Species	Jakarta (n=70)	Bandung (n=78)	Yogyakarta (n=78)	Semerang (n=73)	Surabaya (n=71)	Denpasar (n=74)	χ^2	P
Canary	14.3%(10)	67.9 (53)	30.8 (24)	28.8 (21)	22.5 (16)	16.2.(12)	69.47	<0.001
Long-tailed shrike	20.0 (14)	17.9 (14)	25.6 (20)	39.7 (29)	40.8 (29)	21.6 (16)	18.79	=0.002
Orange-headed thrush	14.3 (10)	30.8 (24)	12.8 (10)	17.8 (13)	11.3 (8)	12.2 (9)	14.93	=0.011
Yellow-vented bulbul	22.9 (16)	12.8 (10)	43.6 (34)	35.6 (26)	19.7 (14)	21.6 (16)	25.56	<0.001
Sooty-headed bulbul	24.3 (24)	23.1 (18)	17.9 (14)	35.6 (26)	16.9 (12)	23.0 (17)	12.48	=0.029
White-rumped shama	17.1 (12)	26.9 (21)	20.5 (16)	24.7 (18)	14.1 (10)	2.7 (2)	19.40	=0.002
Magpie robin	22.9 (16)	14.1 (11)	20.5 (16)	26.0 (19)	11.3 (8)	8.1 (6)	12.79	=0.025
Leafbird spp	15.7 (11)	12.8 (10)	10.3 (8)	20.5 (15)	11.3 (8)	12.2 (9)	4.46	=0.485

Table 6 Proportions of age-groups keeping birds in six cities on Java & Bali.

Species	<25 yrs n=223	26-35 yrs n=404	36-45 yrs n=474	46-65 yrs n=552	65+ yrs n=86	χ^2	P
Pigeon	8.1	4.0	3.0	3.1	1.2	14.53	0.011
Dove	6.3	4.0	5.9	9.6	19.8	32.18	<0.001
Zebra dove	9.0	6.7	10.1	13.6	15.1	14.41	0.006
Songbird	*14.8*	*13.9*	*13.9*	*17.8*	*9.3*	*6.32*	*0.177*
Chicken	*12.6*	*13.6*	*11.2*	*10.5*	*18.6*	*6.04*	*0.196*
All	36.2	33.3	32.8	41.0	46.5	13.14	0.011

Italics – not significant.

Figure 1: Proportions of households in 6 cities of Java and Bali keeping a) different categories of pet and b) different categories of bird.