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Short Communication
European Goldfinches *Carduelis carduelis* as pets in Algeria: numbers and social dimension of a conservation issue

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Summary

Since antiquity, the keeping of finches as pets has been common throughout the Mediterranean countries and it remains a widespread hobby to the present day. Since most finches are sourced from the wild this hobby can have implications for their conservation, especially for already imperilled species. We conducted a survey of 257 households in the city of Guelma, in the north-east of Algeria, and of 70 participants to a European Goldfinch *Carduelis carduelis* show contest in Algiers, to understand the owners' motives for keeping cage birds and find solutions to mitigate any negative effects on the trade. Keeping and showing finches in Algeria is a male-dominated hobby, especially for the 30–40 year age bracket. Our surveys indicate that almost 60% of households had a cage bird, with the European Goldfinch being the most popular species. With a mean of 0.75 goldfinches per household we estimate that in Guelma alone some 17,000 are kept in captivity. Between 70% and 90% of the owners indicated that their birds were indeed wild-sourced, and over 85% of them were aware of the protected status of the European Goldfinch in Algeria. Our findings underline the need for strict enforcement of existing laws and better targeted awareness campaigns to influence the behaviour of owners in order to reduce the demand for wild specimens.

Keywords: Wildlife trade, European Goldfinch, owners' profile, conservation, Algeria

Introduction

Wildlife trade constitutes a major threat to global biodiversity conservation, and many species from a wide range of taxa are traded internationally (Scheffers *et al.* 2019). While a large part of this trade is legal and provides an income for a large part of society, the illegal wildlife trade has been increasingly recognised not only as a significant impediment to conservation but also as an organised crime (South and Wyatt 2011, Pires *et al.* 2016). To tackle the illegal wildlife trade, conservation strategies have focused on international and local enforcement, demand reduction, and local community engagement (Challender *et al.* 2014, Biggs *et al.* 2017, Wallen and Daut 2018), and in recent years there have been calls for measures including consumer demand reduction for wildlife products (Challender *et al.* 2014, Verissimo and Wan 2018). To be effective, such campaigns must understand consumer behaviour and must deliver the right message via the right communication medium (Challender *et al.* 2015, Moorhouse *et al.* 2017), which implies the need for effective social identification of wildlife products consumers.

As indicated by Jepson and Ladle (2009) the social practice of pet keeping is a double-edged sword for the global conservation movement. On the positive side, pet keeping can be considered one of the most important ways of promoting interest in and respect for the non-human world and, unlike zoological parks, allows intimate interactions with strong psychological and social benefits. Affection and admiration for pets may also promote positive attitudes towards the continued protection of wild animals in their natural habitats. On the negative side, pet keeping can also generate threats to populations of wild species, especially when the pets are sourced from the wild. Consumer demand for pets taken from the wild can promote unsustainable supply chains in wildlife in countries and regions that are poorly regulated.

We here focus on the trade in European Goldfinch *Carduelis carduelis* and other birds in north-eastern Algeria. Bird conservation in the Mediterranean thus far is largely focussed on habitat protection (Myers *et al.* 2000, Cox and Underwood 2011, Regos *et al.* 2016, Gaget *et al.* 2020), on rare and endemic birds (Cuttelod *et al.* 2009), on migratory birds and the large-scale killing of birds during the migration periods (McCulloch *et al.* 1992, Bairlein 2016, Brochet *et al.* 2016). Limited attention has been paid to the trade and to the keeping of wild birds as pets (Khelifa *et al.* 2017, Bergin *et al.* 2019, Razkallah *et al.* 2019, Atoussi *et al.* 2020).

Governance and public participation issues are identified as a priority questions for biodiversity conservation in the Mediterranean biome (Moreira *et al.* 2019) highlighting the social dimension of biodiversity conservation and the need of interdisciplinary studies with a strong participation of social scientist (Bennet *et al.* 2017), and this is particularly the case in the Mediterranean biome occurring across five geographic regions with different social backgrounds (Moreira *et al.* 2019).

An estimated 11–36 million wild birds are killed or illegally caught every year in the Mediterranean region (BirdLife International 2011, Brochet *et al.* 2016). Birds are caught for various purposes, notably to be used as food, for medicinal purposes or as caged pets. The latter practice already existed in Ancient Rome where species like the European Goldfinch, European Greenfinch *Chloris chloris*, Common Linnet *Linaria cannabina* and European Serin *Serinus serinus* were caught and caged as pets (Shrub 2013). In various regions, this behaviour has a symbolic and a sociocultural aspect, which contributes to increase the demand (Marshall *et al.* 2020).

Given its singing abilities the European Goldfinch is the most popular cage bird in Algeria (Razkallah *et al.* 2019, Bergin *et al.* 2019). Singing competitions are organised, and as in some Asian countries 'bird-walking' (the avian equivalent of dog-walking, where birds are taken out in cages for fresh air) is an activity often observed (Su *et al.* 2015, Ribeiro *et al.* 2019). This popularity among collectors of caged birds has caused a dramatic decline in its range, estimated for Algeria at 57% (Khelifa *et al.* 2017). The demand can no longer be met through extraction so today most of the birds sold in street markets, and pet shops are sourced and smuggled from Morocco (Bergin *et al.* 2019, Razkallah *et al.* 2019). Future trends in bird trade mostly driven by socio-cultural motivations indicate an increase of the international demand for wild-caught, rather than captive-bred birds (Ribeiro *et al.* 2019).

Three publications on the goldfinch trade in Guelma city (Khelifa *et al*. 2017, Razkallah *et al*. 2019, Bergin *et al*. 2019) show that keeping caged birds is a popular activity. This led us to select Guelma to investigate the characteristics and motivations of cage bird owners through a household survey and through a survey of participants at a European Goldfinch show contest.

Study area and methods

We focussed on keepers of European Goldfinches in two cities in north-eastern Algeria, Guelma and Algiers. Guelma is a medium-sized city and the capital of the province of the same name (~132,000 inhabitants), whereas Algiers is the national capital and largest urban area (~3,155,000 inhabitants). According to the 2015 census (ONS 2015), the national mean household size is 5.8 individuals. By dividing the number of inhabitants by the average mean household size, we have estimated the number of households in the urban areas in the two cities at ~22,800, and ~543,900, respectively.

The data were collected over two periods, in Guelma from 31 January to 19 February 2018 and in Algiers on 10–11 January 2020. The first part of the study consisted of a survey of households using semi-structured interviews. Following Dillman (2014) and based on the population of the province and the average households' size, we estimated that the minimum sample size required to have a representative dataset was 96 households (P set at 50%; margin of error ± 10% of the estimate; 95% CI). We surveyed 257 households. Two native Arabic speakers, trained in interview techniques, conducted the surveys. Only one adult per household was interviewed after having obtained verbal consent. If an eligible individual was not willing to participate or if nobody was at home, sampling continued at the next household. Interviews were anonymous and no identifying information was collected.

The questionnaire was divided into two parts: in the first part, we asked all households if they had cage birds, and if so, what species and how many individuals of each species they owned. This allowed us to estimate the captive population of European Goldfinches and other cage birds. The second part focused only on those households that kept cage birds, i.e. 144/257 households. For these owners we obtained information on (1) their sex, (2) age, (3) level of education (university degree or less), (4) profession (salaried or self-employed), (5) the source of their goldfinches (whether they were captive-bred-birds or whether they were wild-caught), and (6) after all these data were collected, we asked whether the owner thought whether the European Goldfinch was a protected species in Algeria

The second part of the study was a survey of 70 cage bird keepers who take part in a show contest of European Goldfinches held in Algiers. We used a closed-ended questionnaire with multiple-choice questions, where interviewees could answer yes or no, or by choosing an answer from a predetermined choice, the questions were (1) are the European Goldfinches you own captive-bred or wild-sourced? (2) Do you prefer to keep captive bred-birds or wild-sourced ones, and what are the main reasons for this preference? (3) Can you identify the main arguments that may help you to choose to keep captive-bred birds? (4) What are your information sources (social media, written press, radio, television, other)? (5) Are you aware that the species is protected in Algeria? (6) are you aware that the caught and the trade of wild European Goldfinches is illegal. This questionnaire aimed to find out the owners' motivations for keeping wild caught birds, and to identify the conservation messages to which they would be sensitive.

Data analysis

Since the questionnaire we used consisted of closed-ended questions with responses limited to two or three choices, we only used descriptive statistics calculating percentages of each response. The number of European Goldfinches and other wild-caught birds kept as pets in Guelma was estimated by multiplying the number of households by the mean percentage of households with goldfinches, and the total multiplied by the mean number of birds kept per household. To obtain the number of

birds that were harvested from the wild to meet this demand we multiplied this estimate by the proportion of birds that were said to be obtained from the wild.

We applied a multiple correspondence analysis (MCA) to categorise European Goldfinch owners, using SPAD software version 6.5 (Coheris-SPAD, France). Multiple correspondence analysis is a multivariate method for analysing multidimensional contingency tables, used for exploring the associations among multiple categorical variables. The MCA highlights types of individuals with similar profiles in terms of the attributes chosen to describe them, hence the need to identify multiple indicators considered relevant to capture the structure of the phenomenon under study. The first step was the structuring of the data matrix, so we assigned a number to each owner, and each owner was described by attributes collected through the survey. Our structuring modalities used four variables as characteristic attributes: species owned, origin of birds (wild-sourced or captive-bred), sex and age of the owners, and three variables used as illustrative attributes: owners' occupation, level of education, and the number of birds owned (Lebart *et al.* 1995, Ambrogi *et al.* 2005).

Results

Captive population estimates and owner profiles

Results indicate that cage birds were recorded in 56.0% (n = 144) of the surveyed households, 79.9% (n = 115) reported having only one species, and the remaining 20.1% (n = 29) more than one. The majority of cage bird owners 65.3% (n = 94) kept the European Goldfinch with 0.75 birds as the mean individual per household (Table 1). By extrapolation we estimate the captive population in the urban area of Guelma city at 17,122 individuals (error margin ± 10% of the estimate; 95% CI). Twenty-five percent (n = 36) of households that have cage birds kept Canaries *Serinus canaria domestica*, about 6% (n = 9) kept hybrids (Canary × European Goldfinch) and 3% (n = 5) kept Senegal Parrots *Poicephalus senegalus*.

The majority of owners were male (91.0%, n = 131). Owners aged 18 and under, represent 13.19%; 19–30 years represent 41.0%; 31–40 years 34.0%, and 41–60 years 11.8% (Table 2). Regarding the owner's occupation, 41.0% were self-employed, 33.3% jobless or students, and 25.7% had a salaried job. In terms of education there was a more or less equal split between those that had a university degree or equivalent (47.2%) and ones that had no degree or education up to high school level (52.8%).

The multiple correspondence analysis (MCA) identified a dispersion of individuals along four factorial axes. The first two axes explain 79.4% of the total variability, and results pointed out three clearly different types of bird owners (Figure 1). The first group (66.7% of bird owners) were European Goldfinch owners, mostly males aged between 31 and 40 years, self-employed and tend to have education up to high school level. The second group were bird keepers with more than two birds, a preponderance of them being captive-bred hybrids. This group comprised 7.6% of the bird keepers included in the survey. The third group involved Canary owners (25.7%), mostly with captive-bred birds, a significant proportion of female owners, and with a university degree or equivalent level of education and relatively low levels of paid employment.

Conservation and legal protection awareness

Of the European Goldfinch owners in Guelma 85.1% (n = 80) were aware that European Goldfinch is a protected species under Algerian law and that poaching and selling wild individuals is strictly prohibited. This contrasted remarkably with the observation that an equally high proportion of owners (93.6%) indicated that the goldfinch they owned was sourced from the wild. The situation in Algiers was somewhat different. Here 72.9% owned wild-caught European Goldfinches and about a third of owners indicated that they owned only wild-caught birds whereas two-thirds indicated that they kept wild-caught and captive-bred birds. Just over a quarter of the European Goldfinch owners in

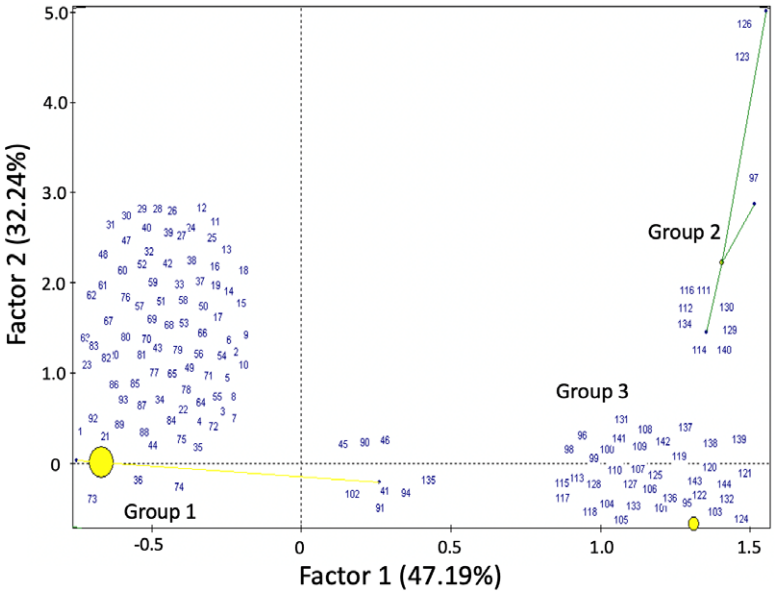

Figure 1. Multi correspondence analysis of cage bird owners' profiles in northern Algeria
Group1: European Goldfinch owners, mostly males aged between 31 and 40 years, self-employed and tend to have up to high school education level.
Group 2: Bird keepers that kept more than two birds, with a preponderance of them being captive-bred hybrids.
Group 3: Canary owners, birds owned are mostly captive-bred ones, a significant proportion of owners being female, and having a university degree or equivalent level of education and relatively low levels of paid employment.

Table 1. Cage birds kept as pets in Guelma, Algeria, based on a survey of 257 households in 2018.

Species	Proportion wild-caught	Proportion of households that keep the species (excluding ones that do not keep cage birds)	Mean number of birds per household (excluding ones that do not keep the species)	Mean number of birds (95% confidence intervals)
European Goldfinch	93.62%	65.25%	0.75	17,122 (15,410–18,834)
Hybrid (European Goldfinch x Canary)	0%	6.25%	0.05	68 (61–75)
Canary	0%	25.00%	0.98	5586 (5027–6145)
Senegal Parrot	100%	3.47%	0.03	27 (24–30)
Parakeet	Unknown origin	2.77%	0.13	79 (71–87)
European Serin	100%	1.38%	0.03	9 (8–10)

Algiers only kept captive-bred birds. Under one third of the owners (28.6%) preferred wild-sourced goldfinches over captive-bred birds, and the main reason for this preference was the better singing abilities of wild-sourced specimens. The remaining owners (62.9%) indicated that they preferred captive-bred ones, suggesting that there may be a shortage of wild-bred birds.

Table 2. Age structure of European Goldfinch keepers in Algeria compared to that of the Algerian population as a whole.

Age (years)	Proportion of Algerian society	Proportion of European Goldfinch keepers	Notes
10 to 18	22.03%	13.19%	Fewer than expected
19 to 30	23.03%	40.97%	Many more than expected
31 to 40	24.51%	34.02%	More than expected
41 to 60	30.43%	11.8%	Many fewer than expected

Only 2.9% of the interviewees in Algiers were not aware that the European Goldfinch was a protected species in Algeria, but a higher proportion (11.4%) indicated they were unaware that the harvest and trade in wild-caught goldfinches was illegal. The majority of interviewees indicated that the main argument that may help them to choose captive-bred birds is the impact of wild-caught birds on biodiversity, and for 11.4% of them the right message would be the illegality of the trade of wild-caught birds. The main source of information reported by the majority of interviewees (72.9%) was exclusively social media; the remaining 27.2% reported a mix of information sources including social media, electronic and print press, radio, and television.

Discussion

To date, market research on species has been the primary means of assessing the impact of trade on wild populations. However, specific consumer surveys provide valuable additional conservation and governance tools for assessing and monitoring human impacts on wildlife populations and generating data that can inform and design policy and social change strategies (Jepson and Ladle 2005, 2009, Hinsley *et al.* 2015, Burivalova *et al.* 2017, Verissimo *et al.* 2020, Kahler 2020). Our approach is similar to that described by Sanchez-Mercado *et al.* (2019) which highlights the need for more targeted interventions to change behaviour along the supply chain, from harvester to consumer, and focuses on the last link in the supply chain.

We estimate the captive population of European Goldfinch in the city of Guelma at over 17,000 birds, with 0.75 European Goldfinches per household. In an earlier study, Khelifa *et al.* (2017) estimated that in Algeria as a whole on average 0.96 goldfinches per household are kept. This led them to conclude that the captive population of European Goldfinch in Algeria was 6.3 million birds (they did not differentiate between cities or between urban and rural areas). Cage bird keeping behaviour actually differs between the northern and southern parts of the country, and between urban and rural areas (similar to seen in other countries; Marshall *et al.* 2020). A sample covering more towns, well distributed across Algeria, would give more accurate estimates of the size of the captive goldfinch population.

Several studies indicate differences in the demographic characteristics of bird owners. In Brazil, Alves *et al.* (2010) reported that males and females are equally involved and that most of the owners were 41–60 years old. Our results indicate that cage bird keeping is particularly popular among males aged from 19 to 40 years old. These results highlight the cultural dimension of bird keeping, and the need to understand the socioeconomical and cultural factors influencing wildlife trade, for the design of local enforcement, and demand reduction campaigns (Reuter and Shaefer 2017).

There is a significant correlation between the level of education, the activity carried out, and keeping caged birds. Our results show similarities with the findings of Jepson and Ladle (2009) and Burivalova *et al.* (2017), whereby respondents with a higher level of education seem to be less likely to own cage birds. In Algeria the majority of European Goldfinches owned were wild-sourced, although wild-sourced birds are more expensive than captive-bred ones. Prices of European Goldfinch depend on the age, colour, and singing abilities of the bird. The minimum price of a

juvenile goldfinch is estimated at USD 32 (Razkallah *et al*. 2019), representing ~10% of the gross monthly national income in Algeria (World Bank 2018). These high prices explain the fact that the majority of owners are workers. Our results are partly in contradiction to Burivalova *et al*. (2017) who concluded that in Sumatra, Indonesia, the main reason why people intentionally bought wild birds as pets was the high cost of captive-bred birds. This obvious preference for wild birds, driven by the perception of wild birds as having better singing abilities seems to be the first driver of this behaviour, thus the demand for wild European Goldfinches in illegal markets and pet shops is important (Bergin *et al*. 2019).

Regarding our results, the majority of cage bird owners are well informed that the European Goldfinch is a protected species in Algeria, and that poaching, transportation, and sale of this species are prohibited. This indicates that this behaviour is not associated with a lack of knowledge about the conservation status of the species. On the other hand, the survey of street markets indicates a deficit in the application of existing laws, and that it presents a mismatch between the panel risks incurred and the benefits derived from this trade, compared to other illegal lucrative activities (Pires 2012, Duffy 2016, Bergin *et al*. 2019, Razkallah *et al*. 2019).

Conclusion and recommendations

Our study highlights the need to understand the human dimension of wildlife trade and consumer preference for wild birds. The popularity of the European Goldfinch as cage birds in Algeria has dramatically contributed to the decline of the wild population. The increase in awareness-raising campaigns and enforcement of regulations are not sufficient to stop the illegal wildlife trade. This failure could be attributed either to the laxity in law enforcement by the authorities in charge of wildlife protection, or to the fact that awareness campaigns so far did not focus on the right message to the right audience.

Recommendations to help overcome these obstacles include the promotion of captive-bred birds and emphasising better coordination between European Goldfinch breeders and hobbyists. This can be achieved by organizing singing or show contests, exclusively open to captive-bred bird owners. Awareness-raising campaigns must deliver the message of the real impact of the wildlife trade on the wild population, and on the illegality of this trade. Given that most of the cage bird keepers included in our study make heavy use of social media, this would be the preferred way of reaching the relevant audiences.

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