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Morphological changes in European goldfinches (Carduelis carduelis) released by bird trappers

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Abstract

*In Spain, several Autonomous Communities have granted licenses to capture European goldfinches (*Carduelis carduelis parva*) during the post-breeding period, from August to December. In Galicia (NW Spain) and other Autonomous Communities, after 5–7 months of captivity, many birds are released. We tested the hypothesis that captivity results in biometric and body condition changes which affect the post-release survival of these birds. We used two groups captured in Galicia, the first made up of birds captured for ringing and the second consisting of birds captured by bird-trappers, kept in captivity for 5–7 months and then released. Two-way ANOVA tests were used to test the effect of group and sex on the wing, bill, head, tarsus and tail measurements. Birds held in captivity had shorter wings and longer bills than those captured for ringing. The significance of these morphometric changes is unknown but it is possible that they could have a detrimental effect on foraging behaviour and post-release survival. In light of this, those involved in keeping wild birds in captivity should review their husbandry techniques.*

Keywords: *animal welfare, biometrics, captivity effects,* Carduelis carduelis*, European goldfinch, trapped birds*

Introduction

Several species of finch have been traditionally regarded as cage birds (Campbell & Lack 1985) and been captured over the centuries to be kept in captivity (Bub 1991). In a number of European countries, it has remained permissible to capture a small number of birds, but there has also been a rather high rate of illegal activity (Kelly *et al* 2008).

In Spain, the capture of finches was restricted by the Law of Nature Conservation enacted in 1989 and the implementation of EU legislation following Spain's entry to the EU in 1986. However, several Spanish Autonomous Communities have, in recent years, granted licenses for post-breeding capture of finches. Currently, ten out of 17 Spanish Autonomous Communities allow the capture of these birds, although the conditions and the approved methods are heterogeneous. The total number of finches captured annually in Spain is unknown but could run into several hundreds of thousands.

In Galicia (NW Spain), licenses have been recently granted for the capture of the European serin (*Serinus serinus*), the European greenfinch (*Carduelis chloris*), the common linnet (*Carduelis cannabina*) and the European goldfinch (*Carduelis carduelis*), although bird trappers generally prefer to capture goldfinches. *C.c.parva* is the goldfinch subspecies that can be found in the Iberian peninsula (Cramp 1992; Tellería *et al* 1999). The goldfinches are captured during two periods, one in August and the other in October, using a clap net with lure birds (Bub 1991). Bird trappers prefer to capture juvenile males in order to use them for breeding and to teach them modified songs with the purpose of taking them to singing competitions.

From 2001 to 2004, the annual capture quota in Galicia was up to 5–7 finches per person, whereas in other regions of Spain the levels were much higher (Belda *et al* 2003). During this period, 644 (± 93.7) goldfinches (range 458–755 birds) were caught legally in Galicia each year, although the actual number of captured birds may have been much higher, given the poaching situation in Spain, as well as other European countries (Kelly *et al* 2008). In Galicia, the license establishes that the birds legally captured have to be released after they have been crossed with other goldfinches and canaries (*Serinus canaria*) and after the singing contests. Release takes place during the first weeks of the year (January–February) and all birds trapped the previous autumn should be set free, although the number of released birds is actually much lower than those captured in the previous season; this is due, among other reasons, to the mortality associated with captivity. The date and location of the release of goldfinches is established by the environmental authorities of Galicia. Although the objective is to return the birds to their natural habitat, there are a number of factors associated with captivity that could adversely affect their post-release survival.

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In this study, we test the hypothesis that captivity may have affected the biometric and body condition of European goldfinches.

Materials and methods

In order to test our hypothesis, we divided the goldfinches into two groups: firstly, the 'wild group', made up of birds captured by the authors of this study in breeding areas and secondly, the second group (the 'captive group'), comprised of wild birds captured by bird trappers, kept in captivity for 5–7 months and subsequently released. The goldfinches of both groups were trapped using clap nets and lure birds in the same locations: the countryside of the northern coast of Lugo (Galicia, northwestern Spain). The clap nets were similar to the Belgian double clap nets (Bub 1991), including the use of 3–4 European goldfinches as lure birds, located both in cages and on seesaw perches.

The wild group was made up of 77 birds trapped in September and October 2003. Age and sex were determined for each bird (Svensson 1992). Using a graduated ruler (precision ± 0.5 mm) we measured the length of the wing (maximum wing chord method) and tail (Baker 1993). The following measures were obtained with a gauge (model Mitutoyo 505–685, Mitutoyo Corporation, Japan) (precision ± 0.1 mm): bill-to-skull, head and tarsus. The weight was obtained using an electronic scale (model Kern 440–447, Kern & Sohn, GmbH Corporation, Germany) (precision ± 0.1 g). All birds were marked only with aluminium rings provided by the Migratory Species Office (Spanish Ministry of Environment) and they were immediately released at the site of capture. Fifty-eight birds (75% of the total) were considered hatched during current calendar year (Euring age three) and 19 birds (25%) were fully grown birds with year of hatching, including current year, unclear (Euring age 2). None had active moult in primary feathers or tail.

The captive group consisted of a sample of goldfinches captured by bird trappers in August and October 2003 and released in February 2004 in Narón (a town in the province of La Coruña), located 60 km from the capture area. The release site was an area with crop fields, alternating with shrubs and woodland. From the total number of released goldfinches (n = 139), 55 were chosen from the cages in which they had been kept prior to release, in an attempt to avoid any bias. To this end, the observer put his hand into the cage and took out each bird while averting his gaze from the contents within. The selected birds were obtained from several bird-trappers. Twenty-seven birds from this captive group (13 males and 14 females) were measured and weighed. The remaining 28 were measured only in part because there was insufficient time to complete all the measurements prior to releasing the birds. All the measurements of wild and captive groups were taken by the same observer and using the same methodology. All selected birds had hatched before the current calendar year (Euring age 4) and none of them had active moult in primary feathers or tail.

Body condition and statistical analysis

We used parametric statistics, after checking the selected groups for normality (using the Shapiro-Wilk test) and variance homogeneity (via the Levene test) (Quinn & Keough 2002).

The hypothesis tested was that captivity conditions could determine changes in certain components of the external morphology of the bird. To this end, two-way ANOVA tests were carried out for non-balanced groups by analysing the effect of group and sex on the length of the wing, bill, head, tarsus and tail. The possible difference between both groups' body condition was also analysed. Body condition was obtained by carrying out a Principal Component Analysis (PCA) per group, using factors such as wing, bill, head, tarsus and tail length. Next, a regression between the first Principal Component (PC1) from a PCA obtained per group and the weights of each bird was carried out. The residues obtained from both regressions made up the individual condition index (Gosler 2004). The comparison between groups was carried out through one-factor ANOVA tests. All means had a corresponding standard error.

Results

Wing length differed significantly between sexes (larger in males than females) and between groups (the captive male and female birds were smaller than those in the wild group) (see Figure 1), but the interaction of both factors was not significant (Table 1). The bill length also showed a highly significant difference between groups (Figure 2), being longer in the captive group (Table 1). This variable did not differ between sexes, nor was the interaction of both factors significant. The remaining biometric variables showed no significant differences (Table 1). Body condition did not differ significantly between groups ($F_{1,97} = 0$; $P > 0.05$) (Figure 3).

Discussion

First, by using the same technique to capture both groups of goldfinches (wild and captive), we ruled out the possibility, from our point of view, of potential differences in bird characteristics associated with the method of trapping.

In the Iberian subspecies of goldfinch (*C.c. parva*), significant differences between sexes in all the normal biometrics (with the exception of tail length) have been documented (Cramp 1992). Similar results were obtained for wing length in birds studied here. Shorter wing length in the captive group gives rise to the possibility of plumage wear due to captive conditions. The cages in which these birds had been kept were particularly small (40 × 25 × 25 cm; length × breadth × height, or smaller), which may have led to rubbing of primary feathers and subsequent wear. Similar deterioration of the plumage has also been described in captive goldfinches released in other parts of Spain (Belda *et al* 2003). An alternative hypothesis to explain shorter wing length in the captive bird group is that these have originated from populations with a lower average wing length. However, that possibility can be dismissed for the following reasons: i) the locations and the capture months of the goldfinches were the same for both groups; ii) the trapping

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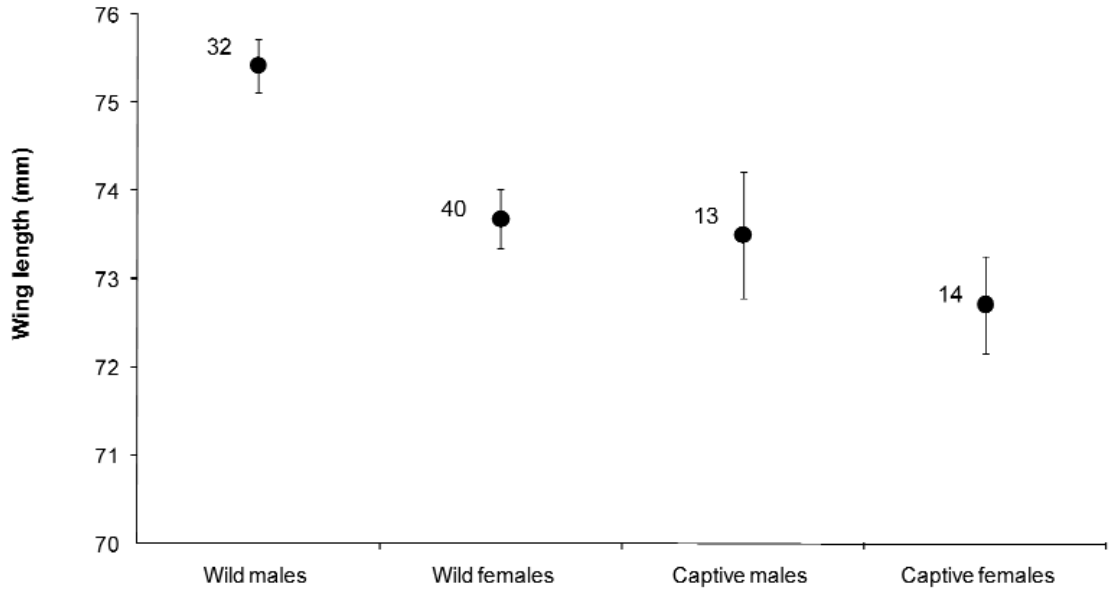
Figure 1



Mean (± SEM) wing length of wild goldfinches (wild group) and captive goldfinches (captive group). Sample size is shown.

Table 1 Two-way ANOVA tests of biometric variables of European goldfinches related to the group (captive vs wild) and sex.

Dependent variable	Source of variation	df	*F*-value	*P*-value
Wing	Group	1	9.86	< 0.01
	Sex	1	7.47	< 0.01
	Group × Sex	1	1.06	> 0.05
	Error	95		
	Total	99		
Bill	Group	1	13.92	< 0.001
	Sex	1	3.80	> 0.05
	Group × Sex	1	1.89	> 0.05
	Error	95		
	Total	99		
Head	Group	1	1.65	> 0.05
	Sex	1	3.63	> 0.05
	Group × Sex	1	0.34	> 0.05
	Error	95		
	Total	99		
Tarsus	Group	1	2.20	> 0.05
	Sex	1	1.18	> 0.05
	Group × Sex	1	0.10	> 0.05
	Error	95		
	Total	99		
Tail	Group	1	0.03	> 0.05
	Sex	1	0.19	> 0.05
	Group × Sex	1	0.73	> 0.05
	Error	95		
	Total	99		

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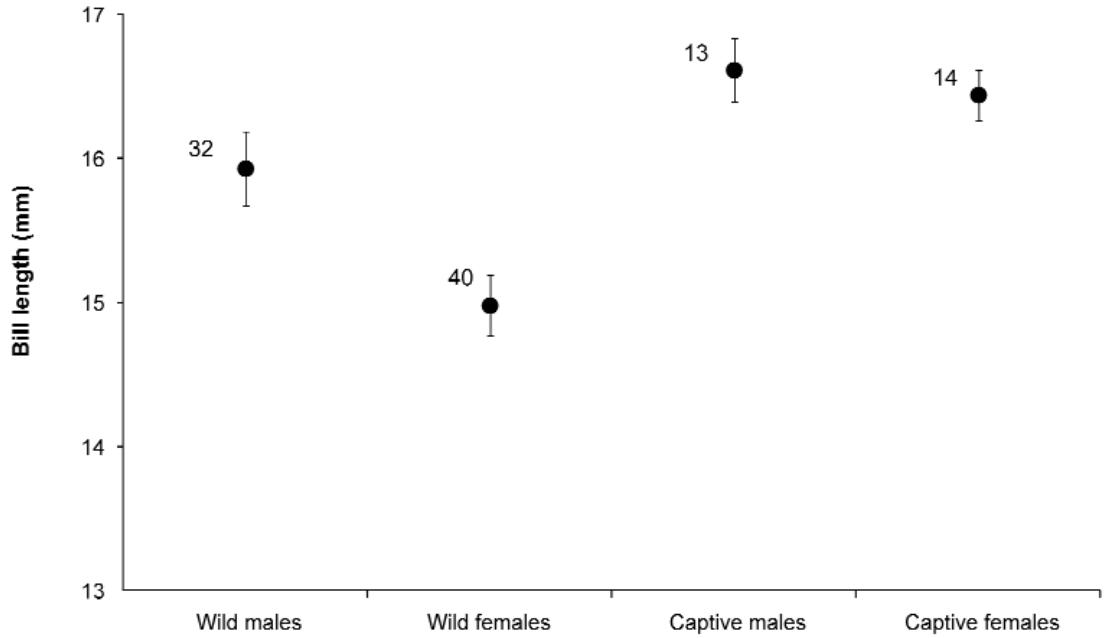
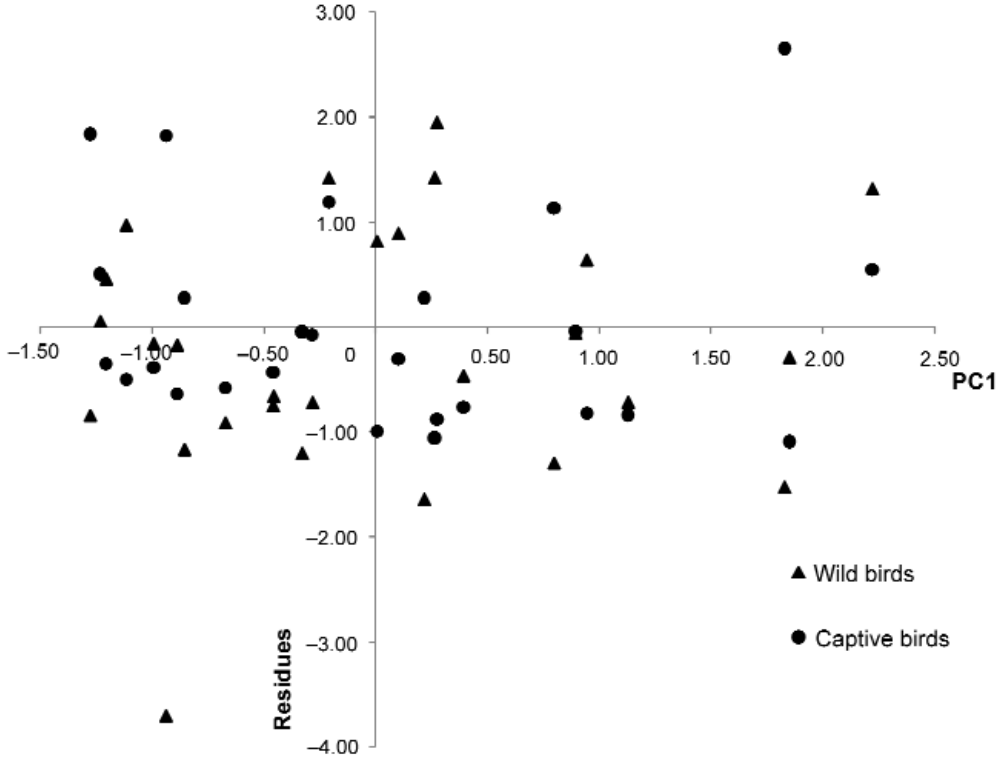
Figure 2



Mean (± SEM) bill length of wild goldfinches (wild group) and captive goldfinches (captive group). Sample size is shown.

Figure 3



Residual values from the regressions between the first Main Component (PC1) and the weights of wild and captive goldfinches (see *Materials and methods*).

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procedure used was similar in both cases; and iii) Iberian populations located close to those in Galicia would have similar sizes whereas overwintering birds coming from Europe and British Isles are bigger than their Iberian counterparts (Cramp 1992). These facts lead us to conclude that both groups were made up of native Galician birds, also taking into account the fact that the arrival phenology of overwintering European goldfinches to the Iberian peninsula is characterised by the massive influx starting from the end of October (Asensio 1986).

The larger bill length of the birds released by trappers was probably due to the reduced rate of abrasion associated with captivity. The changes in bill size may have consequences for the birds' diet, post release, since the size of the seeds selected by these seed-eating birds is directly related to bill size (Díaz 1994). As for the body condition, *ad libitum* feeding of goldfinches from the captive group may explain the absence of differences compared with the wild group, but this lack of difference does not necessarily ensure a similar ability to survive in the wild. Moreover, the condition index could vary seasonally and has limited predictive value concerning the levels of fat and protein (Schamber *et al* 2009).

Changes in feather and bill length may influence post-release survival of the captive group. The increased energetic cost of flight with decreasing wing length for a given body mass is well documented (Pennycuick 1989; Hedenström & Møller 1992) and theoretical and experimental evidence suggests that an increase in flight cost will decrease flight performance (Carrascal & Polo 2006). However, more work is required to clarify the implications of these changes for post-release survival.

Animal welfare implications

These results provide evidence of changes in morphology which might affect survival chances after release. It is our recommendation that those individuals keeping birds in captivity should adopt improved husbandry techniques. Larger cages would result in a lower rate of feather deterioration and the ability to feed on natural food may reduce the detrimental effects on bill size.

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