Winter roosts of Yellowhammers *Emberiza citrinella* in Northern Iberia: population dynamics and biometry

Juan Arizaga, Daniel Alonso, Agustín Mendiburu & Antonio Vilches

Abundance, proportions between age and sex classes and biometrics of a population of Yellowhammers *Emberiza citrinella* captured at winter roosts in reed beds in Navarre (N Iberia) were analysed. Yellowhammers (n = 291) were captured with mist nets from mid-November to the end of February, with a peak in late December. Both age and sex ratios were 1:1, suggesting similar migration distances in both age and sex classes, although further studies are necessary to fully understand this question. Both age and sex-associated dimorphism were detected in measurements of feather length (wing and tail lengths) and wing pointedness and these data can be compared with existing data for the species. Overall, adults and males had longer wings and tails and relatively more pointed wings. The Yellowhammers wintering in Navarre are as large as those found in winter roosts in Catalonia (NE Iberia), but larger than those from Britain. This result is consistent with the sedentary behaviour of British populations and the central European origin of individuals wintering in Iberia. Finally, body mass and fat scores were higher from mid-December onwards, a finding that is probably associated with a strategy oriented towards withstanding long cold nights and starvation. It is thought that this higher fuel load may enable these birds to reach their breeding areas as soon as the weather improves in late winter, thereby allowing them to establish their breeding territories more quickly and survive episodes of adverse weather in breeding areas before the onset of spring.

Key words: Yellowhammer, *Emberiza citrinella*, biometrics, population dynamics, sex and age ratios, winter roosts, Northern Iberia.

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The Yellowhammer *Emberiza citrinella* is a relatively common songbird in the Western Palearctic between 40° to 65°N (Cramp & Perrins 1994, Biber 1997). Originally found in ecotones between open country and forests, today it mainly occurs in mosaic landscapes, forest clearings and plantations with young trees (Cramp & Perrins 1994). Most of the European breeding population (75% according to Tucker & Heath 1994) occurs in a band stretching from Britain and Ireland to Russia, passing through Poland, Denmark and the Czech Republic (Tucker & Heath 1994). It is currently considered to be in moderate decline in countries in central and western Europe such as Britain and Ireland (Biber 1997, Baillie *et al.* 2001; see also http://www.ebcc.info/index.php?ID=190). In Iberia it breeds in the Eurosiberian region and in nearby Mediterranean mountain ranges (Arratíbel 2003). Wintering individuals in Iberia mainly originate from central Europe (Tellería *et al.* 1999).

Data on Yellowhammers in Iberia are fairly scarce and mainly refer to their breeding range

(Arratíbel 2003; see also the review in Tellería *et al.* 1999). Aside from some works on phenology (reviewed by Tellería *et al.* 1999) and biometrics at winter roosts in Catalonia (NE Iberia; Aymí 1993), data on this species' biology and ecology outside the breeding season are scarce.

In this work we studied a winter population of Yellowhammers in Navarre (N Iberia), a region for which the only data available for the species refers to its breeding distribution (Elósegui 1985, Arratíbel 2003). Specifically, we focussed on (1) parameters associated with population dynamics (phenology and age/sex ratios) and (2) biometry; in the latter case, we paid particular attention to traits that would be useful for providing insights into the origin and ecological adaptations of populations.

Material and methods

Sampling area and ringing protocol

Data were obtained at two localities in southwest Navarre (N Iberia): Cirauqui (42°40'N, 01°54'W, 360 m a.s.l.) and Mendigorría (42°38'N, 01°47'W, 350 m a.s.l.). These sites are 8.5 km apart and at each locality Yellowhammers were mist-netted at roosts in reed beds *Phragmites australis* in channels between cereal fields. This area lies in the Mediterranean zone between 300 and 500 m a.s.l. and consists of a mosaic of farmland (cereal fields, vineyards), stands of holm oaks *Quercus ilex* and Aleppo pine *Pinus halepensis* plantations.

We always used 144 m of mist nets (84 m in Cirauqui, 60 m in Mendigorría). The sampling was conducted between November and March in the winters of 2004-2005 and 2005-2006, and in November and December in 2006. Yellowhammers were only captured between November and February (see Results for further details) and so only this period is considered in this work. Captures were made in the two hours before dusk.

Once captured, each bird was ringed and its age and sex determined, following Svensson (1998). We established two age categories: juveniles (EURING code 3/5; individuals with juvenile flight feathers, captured after their post-juvenile moult) or adults (EURING code 4/6, birds captured after their post-breeding moult). For each bird we also recorded (following Svensson 1998): wing length (± 0.5 mm, Method III), tail length (± 0.5 mm), tarsus length (± 0.1 mm), head-and-bill length (± 0.1 mm), length of primary feathers (P2 to P9, numbered from innermost to outermost, ± 0.5 mm), body mass (TANITA digital balance, ± 0.1 g) and fat scores (scaled from 0 to 8, following Kaiser 1993, ± 0.5).

Data analyses

Data from both roost sites were pooled and all the sampling years were considered together. Although variations between these two zones and years may have occurred (e.g. Rubolini *et al.* 2000), a more detailed study would have diminished the sample size too much.

Table 1. Number of Yellowhammers (*Emberiza citrinella*) captured during the winter in two nearby roosts in Navarre (N Iberia). Within each 15-day period, each bird was considered only once. Abbreviations: JV = juveniles (EURING code 3/5); AD = adults (EURING code 4/6); M = males; F = females; NK = not known. *Nombre de verderoles capturades durant l'hivern a dos dormidors de Navarra (nord d'Iberia). Dins de cada període de 15 dies, cada ocell només es va capturar una vegada. Abreviatures: JV = juvenils (codi EURING 3/5); AD = adults (codi EURING 4/6); M = mascles; F = femelles; NK = desconegut.*

Age	JV			AD			NK		
Sex	M	F	NK	M	F	NK	M	F	NK
Nov2	3	2	0	6	6	0	0	0	2
Dec1	8	9	0	7	10	0	0	0	0
Dec2	38	53	0	44	25	0	0	1	0
Jan1	19	27	0	29	20	1	0	0	0
Jan2	3	3	0	4	1	0	0	0	4
Feb1	1	1	0	0	1	0	0	0	0
Feb2	0	0	0	0	1	0	0	0	0
Total	72	95	0	90	64	1	0	1	6

To describe the phenological patterns of the Yellowhammers, 15-day intervals (fortnights) were used as a unit. The number of sampling days per time unit varied and so abundance was expressed as a mean number of captures per sampling day.

Time-associated variations in proportions of age and sex categories were analysed with tests based on χ^2 values. The *P*-exact value was used when more than 25% of expected values were less than 5, or in 2×2 tables (Agresti 1996). In this case, in order to avoid pseudo-replications, each bird was considered only once per time unit.

Differences in biometrics (including wing morphology, see below for details) in relation to age and sex categories were analysed with a Univariate Analysis of Variance (ANOVA). Although measurements may also vary in relation to the date of collection (fortnights), this variable was excluded from these analyses since it would have diminished the sample size too much (Table 1). Alternatively, to test for time-associated variations the residuals from an initial ANOVA (i.e. the dependent variables after removing the age and sex influence) were used in a subsequent ANOVA with fortnights as a factor (for similar analyses see Edelaar & Terpstra 2004, Alonso & Arizaga 2006). In these cases, data from February were omitted due to the low sample size (*N* < 10, see Table 1). The *t*-test was used to compare wing lengths of our sample with those from other wintering populations.

We used the data on P2 to P9 primary feather lengths to estimate C_2 and C_3 indices of wingtip morphology; this procedure enables, respectively, wing pointedness (pointed or rounded wingtip) and convexity (convex or concave wingtip) to be assessed (Lockwood *et al.* 1998; for similar studies see Copete *et al.* 1999, Arizaga *et al.* 2006). The C_2 and C_3 indices are derived from a modified Principal Component Analysis (PCA) and a Size-Constrained Component Analysis (SCCA; Lockwood *et al.* 1998). Higher values of C_2 relate to a relatively more rounded wing, whilst higher values of C_3 correspond to a more convex wing.

Finally, we examined how the body mass and fat scores varied over time. Thus, we performed an ANOVA on body mass with fortnights as factor and the length of wing as a covariate in order to control the effect of body size on body
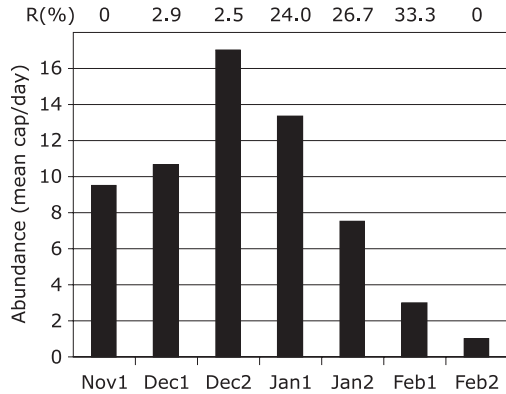

Figure 1. Abundance of Yellowhammers in winter roosts in Navarre (N Iberia). The proportion of recaptures per time unit are also shown (R[%]). *Abundancia de verderoles als dormidors hivernals de Navarra (nord d'Iberia). Es mostra la proporció de recaptures per unitats de temps (R[%]).*

mass. A Kruskal-Wallis test was used to test for time-associated variations in fat scores.

Results

Population dynamics

We captured 291 different Yellowhammers, of which 50 were recaptured on a total of 55 occasions, giving a total of 346 captures. No recaptures from abroad were obtained.

Yellowhammers were captured during 3.5 months from mid-November to the end of February (Figure 1). Maxima occurred in late December (second half of December), decreasing thereafter to late February. No captures were made in March. Overall, the proportion of recaptures increased with time from December to mid-February ($\chi^2_6 = 41.324$, *P*-exact < 0.001; maxima in Feb, with 33.3% of recaptures; Figure 1). The proportion of recaptures was constant in December ($\chi^2_1 = 0.023$, *P*-exact = 1.000).

The proportion between age classes was observed to be constant over time ($\chi^2_6 = 7.061$, *P*-exact = 0.306) and the age ratio was 1:1 ($\chi^2_1 = 0.447$, *P*-exact = 0.504). Likewise, the proportion of sex classes did not vary over time ($\chi^2_6 = 2.735$, *P*-exact = 0.887) and the sex ratio was 1:1 ($\chi^2_1 = 0.012$, *P*-exact = 0.956).

Biometrics

Measurements associated with feather lengths (wing and tail) varied between age and sex classes (Tables 2 and 3). In contrast, no significant differences were observed for the skeletal-associated measurements (i.e. tarsus and head-and-bill lengths, Tables 2 & 3). Wing lengths showed a gradient from adult males (larger values) to juvenile females (shortest mean values). Tail lengths, on the other hand, only varied with sex, males having longer tails than females (Table 3).

Regarding wing morphology, C_2 values were larger in adult males and smallest in juvenile females, indicating that adult males had significantly more pointed wings than

Table 2. Biometrics of Yellowhammers captured in winter roosts in N Iberia. The mean ± SE (mm), range and sample size is shown.
Biometria de les verderoles capturades a l'hivern en dormidors del nord d'Iberia. Es dóna la mitjana ± DE (mm), rang i mida de la mostra.

	Juveniles		Adults	
	Males	Females	Males	Females
Wing length	88.9 ± 0.3	84.6 ± 0.2	90.7 ± 0.3	85.8 ± 0.3
Longitud de l'ala	(78.0 – 96.5)	(81.0 – 94.5)	(81.5 – 95.5)	(82.0 – 92.0)
	N = 66	N = 80	N = 82	N = 56
Tail	75.2 ± 0.4	71.8 ± 0.3	76.2 ± 0.3	72.7 ± 0.3
Cua	(68.0 – 83.0)	(67.0 – 77.5)	(67.0 – 82.0)	(64.0 – 77.0)
	N = 66	N = 80	N = 78	N = 50
Head-Bill	30.4 ± 0.1	30.5 ± 0.1	30.6 ± 0.1	30.6 ± 0.1
Cap-Bec	(28.6 – 32.5)	(29.1 – 32.0)	(28.8 – 32.0)	(29.1 – 32.2)
	N = 64	N = 80	N = 77	N = 49
Tarsus	20.1 ± 0.1	20.0 ± 0.1	20.0 ± 0.1	19.9 ± 0.1
Tars	(18.3 – 21.8)	(17.8 – 21.6)	(18.2 – 22.0)	(17.9 – 21.4)
	N = 66	N = 81	N = 79	N = 50
Wing pointedness (C_2)	0.51 ± 0.02	0.54 ± 0.02	0.40 ± 0.05	0.48 ± 0.02
Índex punta de l'ala	(0.27 – 0.80)	(0.21 – 0.86)	(-2.24 – 0.94)	(-0.09 – 0.75)
	N = 47	N = 63	N = 65	N = 44
Wing convexity (C_3)	-0.88 ± 0.02	-0.92 ± 0.02	-0.95 ± 0.05	-0.85 ± 0.02
Convexitat de l'ala	(-1.27 – -0.51)	(-1.22 – -0.54)	(-3.45 – -0.20)	(-1.34 – -0.25)
	N = 47	N = 63	N = 65	N = 44

Table 3. Univariate ANOVAs of biometric measurements recorded within a winter population of Yellowhammers in N Iberia related to age-sex categories. As well, results derived from the Tukey-B tests are given (age-sex categories in which no significant differences were found are shown with the same superscripts) for those cases in which the ANOVAs gave significant differences. Age-sex categories are ordered from the largest to smallest in relation to their mean value (AM = adult males; JM = juvenile males; AF = adult females; JF = juvenile females). *ANOVAs univariants de les mesures biomètriques obtingudes en una població hivernant de verderoles al nord d'Iberia en relació a les categories edat-sexe. A la vegada, es donen els resultats derivats dels tests de Tukey-B (es mostren les categories edat-sexe en les quals no es van trobar diferències significatives amb el mateix superíndex) per als casos en els quals les ANOVAs van donar diferències significatives. Les categories edat-sexe s'han ordenat des de la més gran a la més petita en relació als seus valors mitjans (AM = mascles adults; JM = mascles juvenils; AF = femelles adultes; JF = femelles juvenils). Vegeu les equivalències en català de les variables a la Taula 2.*

	F	P	Tukey-B			
Wing	$F_{3,283}$ = 121.876	< 0.001	AM[a]	JM[b]	AF[c]	JF[d]
Tail	$F_{3,273}$ = 939.299	< 0.001	AM[a]	JM[a]	AF[b]	JF[b]
Head—Bill	$F_{3,269}$ = 2.136	0.208	—	—	—	—
Tarsus	$F_{3,269}$ = 0.717	0.542	—	—	—	—
Wing pointedness (C_2)	$F_{3,218}$ = 0.732	0.004	AM[a]	JM[ab]	AF[ab]	JF[b]
Wing convexity (C_3)	$F_{3,218}$ = 0.290	0.233	—	—	—	—

Table 4. Univariate ANOVAs of biometric variables with the age and sex effects removed in relation to the fortnightly periods (data from February excluded due to the low sample size, *N* < 10). As well, results derived from the Tukey-B tests are shown (fortnights for which no significant differences were found are shown with the same superscripts) for those cases in which the ANOVAs gave significant differences. Fortnights are ordered from largest to smallest in relation to their mean value.
ANOVAs univariants de les variables biomètriques amb els efectes de l'edat i sexe agrupats en quinzenes (s'han exclòs les dades des de febrer a causa de la baixa mida de la mostra, N < 10). A la vegada, es donen els resultats derivats dels tests de Tukey-B (es mostren les quinzenes en les quals no hi ha diferències significatives amb el mateix superíndex) per als casos en els quals les ANOVAs donen diferències significatives. Les quinzenes s'han ordenat des de la més gran a la més petita en relació al seus valors mitjans.

Residuals of	*F*	*P*	Tukey-B				
Wing	$F_{4,321} = 1.391$	0.237	—	—	—	—	—
Tail	$F_{4,311} = 0.660$	0.620	—	—	—	—	—
Head—Bill	$F_{4,297} = 5.572$	< 0.001	Dec2[a]	Nov2[a]	Jan2[a]	Jan1[a]	Dec1[a]
Tarsus	$F_{4,303} = 2.914$	0.022	Dec1[a]	Dec2[a]	Jan1[a]	Nov2[a]	Jan2[a]
Wing pointedness (C_2)	$F_{4,325} = 0.216$	0.930	—	—	—	—	—
Wing convexity (C_3)	$F_{4,242} = 5.072$	0.001	Jan1[a]	Nov2[a]	Dec1[a]	Dec2[a]	Jan2[b]

juvenile females. No significant differences were observed for the C_3 values for wing convexity (Table 3).

After removing the effects of age and sex, only C_3 values clearly varied throughout the study period (Table 4): birds with more concave wings were captured in late-Feb (due to the low sample size, data from February were omitted). Although significant differences for tarsus and head-and-bill lengths were observed, a Tuckey-B test did not identify any significant differences between fortnights (Table 4).

Data on wing lengths were compared with those from Yellowhammers overwintering in Catalonia (NE Iberia); there were no significant differences for any age and sex categories other than for adult females, which were larger in Navarre (Table 5). On the other hand, Yellowhamers captured in Navarre showed significantly longer wings than those captured during the winter in Britain (Table 5), as Aymí (1993) also found in Catalonia.

Independently of body size, body mass was not constant over time, (Fortnights: $F_{4,320} =$

Table 5. Mean wing length ± SE and the sample size of populations of individuals wintering in Iberia (Navarre and Catalonia) and Britain. The *t* values were used to compare data from Navarre with those from NE Iberia and Britain.
Longitud mitjana de l'ala ± SE i mida de la mostra d'individus de les poblacions que hivernen a Iberia (Navarra i Catalunya) i Gran Bretanya. Els valors de la t s'han usat per comparar les dades de Navarra amb les del nord-est d'Iberia i Gran Bretanya.

	Navarre (N Iberia)	Catalonia (NE Iberia)	Oxford (Britain)
Juvenile females	84.6 ± 0.2 *N* = 80	84.2 ± 0.2 *N* = 192 $t_{81} = 1.830, P = 0.071$	81.8 ± 0.3 *N* = 48 $t_{81} = 13.230, P < 0.001$
Juvenile males	88.9 ± 0.3 *N* = 66	88.8 ± 0.2 *N* = 158 $t_{65} = 0.210, P = 0.835$	87.3 ± 0.4 *N* = 37 $t_{65} = 4.625, P < 0.001$
Adult females	85.8 ± 0.3 *N* = 50	85.2 ± 0.2 *N* = 155 $t_{55} = 2.302, P = 0.025$	83.8 ± 0.3 *N* = 48 $t_{55} = 7.976, P < 0.001$
Adult males	90.7 ± 0.3 *N* = 79	90.4 ± 0.1 *N* = 130 $t_{79} = 1.161, P = 0.249$	89.8 ± 0.4 *N* = 23 $t_{79} = 3.532, P = 0.001$
Source	This work	Aymí (1993)	Evans (1969)

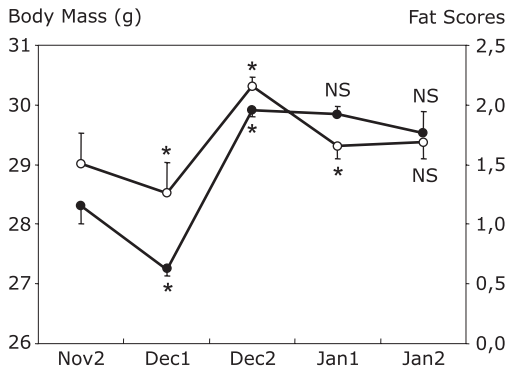Body Mass (g)   Fat Scores

Figure 2. Seasonal variations of body mass (white dots) and fat scores (black dots) in a population of Yellowhammers overwintering in Navarre (N Iberia). Pairwise comparisons were carried out. Differences in each fortnight in relation to the previous fortnight are shown if significant (* *P* < 0.05; NS non-significant).
Variació estacional de la massa corporal (cercles blancs) i puntuació de greix (cercles negres) en una població de verderoles hivernants a Navarra (nord d'Iberia). Es van fer servir comparacions aparellades. Es mostren les diferències significatives de cada quinzena en relació a la quinzena anterior (P < 0.05; NS no-significativa).*

8.467, $P < 0.001$; Covariate, wing length: $F_{1,320}$ = 54.067, $P < 0.001$). Thus, body mass decreased from late November to December, with a maximum in late December, decreasing thereafter into January (Fig. 2).

Fat content varied throughout the study period (K-S test, χ^2_6 = 81.320, $P < 0.001$), even when data from February were removed (K-S test, χ^2_4 = 76.512, $P < 0.001$); the highest values were observed in late December and January (Fig. 2).

Discussion

Population dynamics

Yellowhammers were captured at winter roosts in reed beds in Navarre (N Iberia) between mid-November and the end of February, with maxima in late December. Overall, this pattern agrees with the data provided by Cramp & Perrins (1994) for the occurrence of Yellowhammers in their wintering range. The autumn migration period in Europe is documented as lasting from September to November (sometimes up to December), whilst spring migration occurs from February to May (Cramp & Perrins 1994). Thus, the Yellowhammers we captured in roosts in reed beds are likely to correspond to a wintering population mainly formed of individuals more or less established within the region, rather than migrants or vagrants passing through the area. This is consistent with the increasing proportion of recaptures during the winter (with maxima in February).

The sex ratio was 1:1 and did not vary over time. We can assume that the sex proportion at breeding localities is also 1:1 (Cramp & Perrins 1994; but see Donald 2007 for a review on adult sex ratios) and thus our results support the idea that migration distances performed by Yellowhamers (and thus the location of their wintering areas) are independent of sex, as suggested by several authors (Prŷs-Jones 1977, Cramp & Perrins 1994). Nonetheless, this is only the most plausible rationale since we have no data on sex ratios of Yellowhammers in their breeding areas in Europe.

Similarly, the age ratio was found to be 1:1 and did not vary over time either. It is not rare in passerines that offspring outnumber adults at the end of the breeding season. Thus, if this is the general pattern in Yellowhammer breeding quarters, then the proportion of ages in our study were biased towards adult birds, which could be due to a number of factors: (1) different age categories are geographically segregated in winter; (2) different age categories show habitat-related segregation in winter; (3) age proportions are biased by methodological problems; or (4) survival rates are higher in adults than in juveniles. (1) There is no evidence that migration distances in juvenile Yellowhammers are longer than in adults (Cramp & Perrins 1994), as has been observed for other short-distance migrants (for a review, see Cristol *et al.* 1999). Nevertheless, little data is available. (2) Juveniles tend to use the same habitats as adults (Cramp & Perrins 1994), although again data on this subject is scarce. (3) Our age ratio could be biased by methodological questions, although in our opinion this hypothesis is less plausible than the other factors since neither living decoys nor tape lures were used (these techniques are known to bias age proportions, e.g. Weatherhead & Greenwood 1981, Borrás & Senar 1986). (4) Higher post-breeding survival rates

in adult birds than in juveniles would seem to be the most plausible explanation for our results, which are consistent with the general demographic patterns of passerines.

It is worth highlighting that to be able to obtain firm conclusions on both the sex and the age ratios of Yellowhammers in their wintering areas we still need to know (1) what the sex and the age ratios are in breeding quarters and (2) where the birds captured in winter roosts come from.

Biometrics

Both age- and sex-associated dimorphism were detected for two measurements associated with feather lengths (wing and tail lengths), but not for tarsus and head-and-bill lengths. This agrees with the data provided for the species overall (reviewed in Cramp & Perrins 1994), resulting in a gradient whereby adult males have the largest values and juvenile females the smallest, as reported for many other bird species (e.g. Amadon 1959, Fairbairn 1997).

This dimorphism was also seen in wing morphology, with adult males having relatively more pointed wings. Increasing wing-pointedness is classically associated with higher flight efficiency (e.g. Pennycuick 1975, Norberg 1989) and long-distance migrants tend to have more pointed wings than short-distance migrants or resident species (Mönkkönen 1995, Calmaestra & Moreno 2001). However, Swaddle & Lockwood (2003) observed recently for the Starling *Sturnus vulgaris* that birds with a more pointed wing did not show either higher flight speeds or better manoeuvrability than those with a more rounded wing. They observed that birds with more rounded wings took-off at a more vertical angle than those with more pointed wings (Swaddle & Lockwood 2003). In general steeper take-off angles reduce the risks of predation (Alatalo *et al.* 1984, Witter *et al.* 1994, Kullberg *et al.* 1996, Lind *et al.* 1999). Alternatively, more pointed wings in adult males could be associated with (1) a morphological adaptation for display behaviours, as suggested Borrás *et al.* (1998) for the Citril Finch *Serinus citrinella*, or with (2) a signal associated with sexual selection pressures. Adult males with more pointed wings would be handicapped in terms of the risk of predation (they take off at less vertical an-

gles) and so only the best equipped birds would be able to survive with this morphology. For this hypothesis to be true, these birds would have to be positively selected by females, a fact that should be investigated in future studies.

As no recaptures from abroad were obtained, the origin of yellowhammers captured in winter roosts in Navarre is unknown. After consulting the data set of recaptures from abroad from the Aranzadi Ringing Scheme, a single capture of a bird ringed in southwest France and recaptured in the Basque Country was found to exist, a fact that supports that the idea that birds overwintering south of Pyrenees may come from abroad and perhaps belong to relatively close populations breeding in France. On average, Yellowhammers captured in Navarre had wings (which could be interpreted to assess body size; Gosler *et al.* 1998) as long as those found by Aymí (1993) in wintering birds in Catalonia (NE Iberia). However, this is insufficient evidence to be able to conclude that the origins of birds overwintering in Navarre and Catalonia are similar, given the high overlap of wing length over extended geographic ranges in mainland Europe (Cramp & Perrins 1994). Indeed, Yellowhammers captured in Navarre were larger than those from a winter population in Britain (Evans 1969), which might be consistent with the fact that (1) unlike the British and Irish populations, which are sedentary (Prŷs-Jones 1977; Wernham *et al.* 2002), individuals wintering in Iberia mainly come from mainland Europe (C and S Europe; Cramp & Perrins 1994); (2) birds from breeding populations from Britain and Ireland have shorter mean wing lengths than many populations from mainland Europe (Cramp & Perrins 1994).

Both body mass and fat scores showed higher values from late December onwards, as observed by Spina & Licheri (2003) in Italy. Although significant, this variation was not very high. Body mass differed on average by less than 2 g between early (minimum) and late December (maximum). Greater fuel reserves during the winter (from late December onwards) may be due to the fact that during this season Yellowhammers have to survive long cold nights (Elkins 1990). As well, higher fuel reserves in winter may enable these individuals to leave their wintering areas as soon as weather conditions improve, thereby allowing them to reach

their breeding quarters sooner. This would allow birds to increase their chances of occupying the most suitable breeding territories.

Resum

Dormidors hivernals de Verderoles *Emberiza citrinella* al nord d'Iberia: dinàmica de poblacions i biometria

S'analitza l'abundància, proporcions entre classes d'edat i sexe, i biometria d'una població de Verderoles *Emberiza citrinella* capturades en dormidors hivernals situats en canyissars de Navarra (N d'Iberia). Les verderoles (n = 291) es van capturar amb xarxes japoneses des de la segona meitat de novembre fins a final de febrer, amb un pic a finals de desembre. Tant la proporció d'edats, com la de sexes va ser 1:1, cosa que suggereix distàncies de migració similars per a cada classe d'edat i sexe, tot i que són necessaris més estudis per conèixer aquest aspecte amb més detall. Es va detectar dimorfisme associat a l'edat i el sexe en les mesures de la longitud de l'ala i la cua i en el forma més punxeguda de l'ala en comparació amb les dades disponibles per a aquesta espècie. Els adults i els mascles van tenir ales i cues més llargues i ales relativament més punxegudes. Les verderoles que hivernen a Navarra són tan grans com les que ho fan a Catalunya (NE Iberia), però més grans que les de Gran Bretanya. Això concorda amb el comportament sedentari de les poblacions britàniques i l'origen centroeuropeu dels individus que hivernen a la península Ibèrica. Finalment, la massa corporal i la puntuació de greix van ser més altes a partir de la segona meitat de desembre, cosa que probablement està associada amb una estratègia orientada per fer front les llargues nits fredes. La major acumulació de greix pemetria a aquests ocells arribar a les seves àrees de cria tan aviat com millorés el temps a final d'hivern, a la vegada que els permetria establir els territoris de cria més ràpid i sobreviure als episodis meteorològics adversos abans de l'arribada de la primavera.

Resumen

Dormideros hibernales de Escribano Cerillo *Emberiza citrinella* en el norte de Iberia: dinamica de poblaciones y biometría

Se analiza la abundància, proporciones entre clases de edad y sexo, y biometría de una población de Escribano Cerillo *Emberiza citrinella* capturada en dormideros hibernales situados en carrizales de Navarra (N de Iberia). Los escribanos (n = 291) se capturaron con redes japonesas desde la segunda mitad de noviembre hasta finales de febrero, con un pico a finales de diciembre. Tanto la proporción de edades, como la de sexos fue 1:1, cosa que sugiere distancias de migración similares para cada clase de edad y sexo, aunque son necesarios más estudios para conocer esta cuestión con mayor detalle. Se detectó dimorfismo asociado a la edad y el sexo en las medidas de la longitud del ala y la cola, y en la forma más puntiaguda del ala en comparación con los datos disponibles para esta especie. Los adultos y los machos tuvieron alas y colas más largas y alas relativamente más puntiagudas. Los escribanos cerillos que invernan en Navarra tienen medidas similares a los que lo hacen en Cataluña (NE Iberia), pero son mayores que los de Gran Bretaña. Esto concuerda con el comportamiento sedentario de les poblaciones británicas y el origen centroeuropeo de los individuos que invernan en la península Ibérica. Finalmente, la masa corporal y la puntuación de grasa fueron más altas a partir de la segunda mitad de diciembre, aspecto que probablemente esta asociado a una estrategia orientada a soportar las largas noches frías. La mayor acumulación de grasa permitiría a estas aves llegar a sus áreas de cría tan pronto como mejorase el tiempo a final de invierno, a la vez que les permitiría establecer sus territorios de cría más rápidamente y sobrevivir a los episodios meteorológicos adversos antes de la llegada de la primavera.

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