WINTERING AND MIGRATION OF BLUETHROAT
LUSCINIA SVECICA IN CENTRAL SPAIN

Ana BERMEJO*1 & Javier DEL A PUENTE**

SUMMARY.—Wintering and migration of Bluethroat Luscinia svecica in central Spain.

Aims: Birds have been able to change their breeding and wintering areas by tracking variation in different conditions. In the last decades, the winter distribution of the Bluethroat had been changing. This passerine winters mainly in Africa, although observations of birds wintering in Iberia have increased since the 1970s. We describe its migration and wintering patterns in central Spain, and try to understand the causes for this change in the wintering range.

Location: The study was conducted at Las Minas Ringing Station (San Martín de la Vega, Madrid, 40.13°N 6.32°W).

Methods: Data used was obtained at a constant ringing effort site in central Spain from 1995 to 2002. Captured birds were ringed, aged and sexed, and a variety of biometrics was taken.

Results: Bluethroats captured in central Spain belonged to the cyanecula and namnetum subspecies, and come from central Europe. First birds arrived in late August or early September, and last birds left at the end of March. Part of the population annually winters in the area exhibiting similar patterns of arrival and departure dates throughout the years, and shows a high return rate. More males than females were captured, especially in winter. Wintering and non-wintering Bluethroat populations were similar in structure, biometrics and body condition, therefore wintering birds did not seem to be birds that for some reason (e.g. small size, bad body condition, inexperience), were unable to reach their usual wintering quarters in Africa.

Conclusions: Wintering in Iberia could be advantageous because birds wintering closer to their breeding areas may arrive there earlier than those wintering in Africa. The results point to this hypothesis: the wintering population was comprised mainly of males, they arrived at the wintering area on a similar date each year, were in better body condition than other birds in winter and the return rate of the wintering population was high.

Keywords: Bluethroat, central Spain, Luscinia svecica, migration, wintering.

RESUMEN.—Invernada y migración del Pechiazul Luscinia svecica en el centro de España.

Objetivos: A lo largo del tiempo, las aves han sido capaces de cambiar sus áreas de reproducción y de invernada, adaptándose a los cambios producidos por diferentes variables. En las últimas décadas, la distribución invernal del Pechiazul ha cambiado. Este paseriforme inverna principalmente en África, aunque desde los años 70 las observaciones de aves invernando en Iberia se han incrementado. Se describen la migración y la invernada del Pechiazul en el centro de España, tratando de entender el cambio de su distribución invernal.

Localidad: El estudio se desarrolló en la Estación de Anillamiento de Las Minas (San Martín de la Vega, Madrid, 40.13°N 6.32°W).

Métodos: Se emplearon los datos obtenidos entre 1995 y 2002 en una estación de anillamiento de esfuerzo constante ubicada en el centro de España. Las aves capturadas fueron anilladas, datadas, sexadas y se les tomaron diversas variables biométricas y de condición física.

Resultados: Los pechiazules capturados en el centro de España pertenecen a las subespecies cyanecula y namnetum, y proceden de Centroeuropa. Las primeras aves llegan a finales de agosto o principios de septiembre, y las últimas aves abandonan el lugar a finales de marzo. Parte de la población permanece en el área todo el invierno siguiendo un patrón constante todos los años y mostrando una elevada tasa de retorno. En general, se capturan más machos que hembras, sobre todo en invierno. La población invernante y la no invernante presentan estructura, biometría y condición física similares, por lo que los individuos invernantes no parecen ser aves que por alguna razón (p. ej. pequeño tamaño, mala condición física, inexperiencia), no son capaces de alcanzar sus áreas de invernada habituales en África.

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Throughout time, birds have been able to change their breeding and wintering areas by tracking variation in different conditions such as climate or anthropization (Berthold, 2001). The causes of the changes are not usually easy to determine, but by analysing some individual (body size, condition) and population variables (population structure, return and survival rates), an attempt can be made to explain these distributional changes in more detail. To describe in detail the pattern of distribution and the phenology of a species, it is necessary to monitor populations across time using a constant effort sampling suited to the species. The monitoring of passerine populations is usually studied by means of constant effort ringing sites. This method has several advantages: (1) the sample effort is objective and independent of the sampler; (2) it is very useful in dense vegetation and habitats where birds are difficult to detect visually; and (3) capturing the bird allows one to analyse individual variables (i.e. sex, age, biometrics, or body condition).

The Bluethroat *Luscinia svecica* is a trans-Saharan migrant whose Western European populations (Zink et al., 2003) winter mainly in Africa (Cramp, 1988), although in the last decades its wintering areas seem to be extending northwards (Gómez-Manzaneque, 1997a). Now Bluethroats winter also in the south and southeast Iberian coast, with some observations in central and northern Iberia (Bueno, 1990; Gómez-Manzaneque, 1997b; Tellería et al., 1999; Hernández et al., 2003). Nevertheless there is little detailed information about this wintering, and also about Bluethroat migration throughout Iberia (Bueno, 1990; Hernández et al., 2003). The first observations on wintering in the Iberian Peninsula were made in 1973 in Zaragoza (Aragüés, 1974). In the mid 80’s there were more references about individuals wintering in central Spain (A. O. Ardeidas, 1985; Gómez-Manzaneque et al., 1986), and from the early 90s until now there have been more observations of Bluethroats wintering both on the coast and the centre of Iberia (e.g. De Juana, 1993, 1994, 1995, 1996), in some cases corroborating that the species winters in the same site during different years. It could be argued that the non-wintering of the Bluethroat in Iberia in the 1960s could be due to a lack of data instead to a real non-wintering, because there were very few birds wintering, birds were difficult to detect in winter as they do not sing and show the same behaviour than in the breeding period, and the sample effort could not permit detection of the species. Nevertheless, Bluethroats winter mainly in reedbeds or riparian vegetation (Pérez-Tris, 2002), a habitat which has been well sampled in winter in the last decades (Atienza & Justribó, 1999).

Until now, Bluethroat timing of wintering and migration have been analysed mainly in the Mediterranean coast, always within studies of avian communities (see review in Tellería et al., 1999), except for a detailed study about the species in south-eastern Spain (Peiró, 1997a). Using recovery data, Bueno (1990) summarized the phenology in Iberia but did not find the species in central Spain. However, Gómez-Manzaneque (1997b) pointed to a wintering of Bluethroats in central Spain according to non-constant effort ringing data. Recently, Hernández et al., (2003), after analysing Bluethroat recovery data, indicated that the species probably does not winter in northern and central Iberia, as recoveries in those areas were scarce.

Data obtained in a ringing station for an eight-year period were used to analyse the migration and wintering of Bluethroat in central Iberia. The aims of the study were: (1) to obtain the phenology of Bluethroat in a non-breeding area; (2) to corroborate that there were wintering and migrating individuals in all years, following a constant pattern; (3) to analyse some parameters of the population (age-ratio, sex-ratio, return rate) and the individuals (biometrics, body condition) trying to understand why birds winter in the study area.
MATERIALS AND METHODS

The study was conducted at Las Minas Ringing Station (San Martín de la Vega, Madrid, 40.13°N 6.32°W). This area is a reedbed of *Phragmites australis* along the Jarama River, with reedmace *Typha domingensis*, willows *Salix alba*, poplars *Populus alba*, and rushes *Juncus* ssp. Birds were mist-netted once a week between April 1995 and December 2002 within a constant effort site and with consistent sampling methods, i.e. as for number and position of mist nets, net size and type, timing of bird trapping, and sampling frequency. A total mist-net length of 132-144 m, depending on year, placed in standard straight lines was operated for six hours from dawn. To analyse in more detail the postbreeding migration, a daily trapping effort was applied in September 2000, from August 16th until September 30th in 2001, and from August 16th until October 15th in 2002, also using an extra mist-net length of 84 m, and all the nets were operating for six hours after dawn and four hours before nightfall.

All trapped birds were ringed and sexed following Svensson (1996). Birds were aged by plumage traits (Jenni & Winkler, 1994; Svensson, 1996), distinguishing between juveniles (born in the preceding breeding period) and adults (older birds). Measurements were made of the wing maximum chord and the length of the eight primary feather to the nearest 0.5 mm, and the tarsus length (toes bent) to the nearest 0.1 mm (see Svensson, 1996, for details). Body mass was recorded with precision of 0.1 g. Fat content was visually estimated using a 9-score scale (Kaiser, 1993). Males were ascribed to subspecies by the presence and the colour of the central spot in the breast (white spot or absent: *cyanecula* group, red spot: *svecica*). Subspecies *namnetum* was identified by wing length (adult male < 72 mm, adult female < 68 mm, juvenile male < 69 mm, juvenile female < 66 mm; Cramp, 1988; Svensson, 1996; Eybert et al., 1999).

**Phenology**

Phenology of the species in the study area was determined according to patterns in: (1) the temporal distribution of captures, (2) body mass and (3) subcutaneous fat. Because a different sampling effort was used in the last three years of the study (see above), only the first five winters were taken into account to define the phenology of the species in the study area in two-week periods. As the mist net length was very similar in those winters, there was no correction for capture effort. Because the fat is the main energetic reserve that birds use during migration, and body mass changes in migration are mainly due to fat accumulation (Berthold, 1975; Jenni & Jenni-Eiermann, 1998), by analysing the seasonal changes in body mass and subcutaneous fat the migration period may be obtained. Eight study years were used to analyse those changes.

**Demographic parameters**

The age ratio and the sex ratio among autumn, winter and spring periods were compared using a log-linear analysis. Only the first capture of a bird per each period in each wintering was considered. Due to small sample size, all years were grouped for this analysis. The return rate of the wintering population was calculated as the percentage of birds that were recovered in two or more different winters compared to the whole wintering population. Wintering and non-wintering populations return rates were not compared, because their different stay period in the study area affected the recapture rate.

**Biometrics and body condition**

Wing length, eight primary length and tarsus length as measurements of body size of Bluethroats between wintering and autumn passage populations were compared using a three-way ANOVA in relation to population, age and sex. To analyse the differences in the wing morphology independently of the bird size, we used an ANCOVA using tarsus length (a structural measurement of the bird; Senar & Pascual, 1997) as the covariate, and wing length as the dependent variable. *Namnetum* birds were excluded from these analyses due to their small size (their biometrics is shown apart). The spring passage population was not considered as an independent group due to the small number of birds captured in this period. Neither could they be grouped with the autumn group.
because the large differences in the capture date could affect the analysis, especially of plumage characters which change along time due to abrasion. In these analyses, only the first capture of each bird was used to avoid pseudoreplication. All years were considered together because differences in biometrics in relation to year were not found (all \( P > 0.357 \), excluding *namnetum*), and the use of year as a factor would drastically reduce the sample.

Because fat storage is the main determinant of changes in body mass of migrating birds, fat contents were analysed to ascertain the migratory condition of birds (Jenni & Jenni-Eiermann, 1998). As an index of body condition, residual body mass relative to body size was used (measured as tarsus length; Senar & Pascaul, 1997) and fat levels obtained from an ANCOVA (Brown, 1996). To linearize its relationship with body mass and apply parametric statistics, the logarithm of the squared fat scores plus one was used as the final measure of stored fat (Pérez-Tris *et al*., 2001); body mass was also log-transformed to improve normality of residuals. Fat contents and body condition indices between ages and sexes in both autumn and winter season were compared separately.

**Rate of weight change and duration of the autumn stay period**

Taking into account the recaptures of birds in the autumn campaigns, the weight change rate of a bird was defined as the difference in body mass between the last and the first capture in the same autumn season, divided by the number of days elapsed between the two capture events, namely the stay period. This rate was compared between wintering and non-wintering population, while rates in the stay period were not compared because the former was supposed to stay in the study area for a longer time. There was a correlation between body mass and hour of capture \( (r = 0.41, P < 0.001, n = 108) \). To avoid this effect on the rate of weight change, weight change rate was standardised for time of capture using the residuals of the regression body mass = 2.62 + 0.09 capture time \( (r^2 = 0.14, F_{1,32} = 5.07, P = 0.031) \), and the variables log-transformed to improve normality.

**RESULTS**

Bluethroats were captured 452 times throughout the study period, corresponding to 283 different individuals (65 adult males, 35 adult females, 101 juvenile males, 61 juvenile females, and 21 birds of indeterminate age or sex). Eight birds had been ringed in foreign countries (3 in Holland, 3 in Belgium, and 2 in France), two of them during the breeding period. Two of the foreign birds stayed and wintered in Las Minas. No bird ringed in the study area was recovered away from it. Plumage morphs of adult males supported the West-European origin of Bluethroats, 42% of birds showing a white spot and 58% lacking spot. Body dimensions allowed the identification of some birds of the subspecies *namnetum* (8 out of 283 birds, 2.8%). None of the *namnetum* birds was an adult male, and only one of them was captured in the winter period (November 25th).

**Phenology**

The postbreeding migration started usually in late August or early September (mean of first capture dates in eight years: 27th Aug ± 6.5 days), and extended until the first two-week period of November (which included 56% of the total of captures). The peak of migration was in the second two-week period of September (Fig. 1), coincident with the highest body mass and fat averages (Fig. 2). Juveniles arrived earlier than adults to the area, but both males and females showed similar arrival dates (adult males = 9th Sep ± 10.4; adult females = 22nd Sep ± 20.2; juvenile males = 4th Sep ± 7.4; juvenile females = 5th Sep ± 19.7; within-year ANOVA with age and sex as repeated measures factors: Age: \( F_{1,7} = 38.02, P < 0.001 \); Sex: \( F_{1,7} = 2.21, P = 0.181 \); Age x Sex: \( F_{1,7} = 1.88, P = 0.213 \)). The date of first arrival was less variable in males than in females (Levene’s test in the former ANOVA: Age: \( F_{1,7} = 0.77, P = 0.410 \); Sex: \( F_{1,7} = 8.50, P = 0.022 \); Age x Sex: \( F_{1,7} = 0.01, P = 0.919 \)).

In the prebreeding passage (12% of the total of captures), birds started to increase their body mass in early March (Fig. 2). Captures peaked in the first two-week period of March (Fig. 1), and the passage finished at the end of this month, or even in April (mean of last capture
dates in seven years: all birds = 21st Mar ± 14.8 days; adult males = 13th Mar ± 9.6; adult females = 12th Mar ± 14.4; juvenile males = 28th Feb ± 18.4; juvenile females = 7th Mar ± 20.4). This passage had less importance than the post-breeding one, and some years were scanty.

Wintering extended between mid-November and late February (32% of the total captures). Some wintering birds were captured in September (n = 10), and some left in late March or in early April (n = 9). Taking into account these results, wintering birds (60 birds, 21% of the total) were considered as those that were ringed between 16th November and 28th February.

Demographic parameters

A log-linear analysis of the frequency of different sex and age classes in autumn, winter and spring revealed a similar proportion of each group of birds among seasons (all possible interactions with \( P > 0.21 \), thus the wintering population has a similar structure to the one that, in fact, uses the area for stop-

**Fig. 1.—**Phenology of the Bluethroat in central Spain (top), as the percentage of the total captures from July 1995 to June 2000 (256 captures), and relative percentage of birds, separated by age and sex (bottom), in each two-week period. [Fenología del Pechiazul en el centro de España (arriba), indicado como el porcentaje por quincenas del total de capturas entre julio de 1995 y junio de 2000 (256 capturas), y el porcentaje relativo de aves según sexos y edades por quincenas (abajo).]
Nevertheless, in general, more males than females were captured in both adult and juvenile birds, while the age ratio was approximately 1:1, and females were scarcer in winter (from November to mid-February, Fig. 1).

The return rates of the wintering population were high (adult male 47%, adult female 50%, juvenile male 34%, juvenile female 36%), and similar among sex and age classes (all possible interactions in a log-linear analysis with $P > 0.34$). This wintering population had significantly more males than females ($\chi^2 = 14.15, P < 0.001$), and more juveniles than adults ($\chi^2 = 8.93, P = 0.003$).

**Biometrics and body condition**

Biometry was similar between the wintering and the non-wintering population (Table 1), although in general males were bigger than females, and adults showed longer wings than juveniles did. These differences were not explained by variation in body size, as the same variation was found in wing dimensions including tarsus length as a covariate in an ANCOVA (results not shown).

Fat levels did not differ between ages or sexes in autumn, but in winter juveniles showed less fat than adults, although probably the small sample size of adult females in this season made this difference to be non-significant (Table 2). Although in general the birds showed a similar body condition index between seasons (Fig. 3), within each season the body condition varied in relation to age and sex. In autumn, males were in a slightly better condition than females for both adults and juveniles. Nevertheless, in the wintering population adult males showed the best condition index, while adult females presented the poorest one (Table 2, Fig. 3); in this case the interaction was marginally significant, again probably due to the small sample size.

**Rate of weight change and duration of the autumn stay period**

The autumnal weight change rate did not differ between non-wintering ($-0.20 \pm 0.32$ g/day,
Biometrics of the Bluethroat in central Spain, and ANOVA results of the comparison of biometrics according to age, sex and population (excluding *namnetum* birds). Shown are means, standard deviations and sample sizes (between brackets).

<table>
<thead>
<tr>
<th>Age [Edad]</th>
<th>Sex [Sexo]</th>
<th>Population [Población]</th>
<th>Wing (mm) [Ala (mm)]</th>
<th>Eight feather (mm) [Octava primaria (mm)]</th>
<th>Tarsus (mm) [Tarsó (mm)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult [Adulto]</td>
<td>Male [Macho]</td>
<td>Autumn [Otoño]</td>
<td>76.7 ± 2.3 (41)</td>
<td>58.2 ± 2.0 (41)</td>
<td>26.54 ± 0.71 (30)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Winter [Invierno]</td>
<td>76.0 ± 1.9 (14)</td>
<td>57.2 ± 1.9 (14)</td>
<td>26.21 ± 0.72 (13)</td>
</tr>
<tr>
<td>Female [Hembra]</td>
<td></td>
<td>Autumn [Otoño]</td>
<td>72.9 ± 2.2 (26)</td>
<td>54.9 ± 1.8 (26)</td>
<td>25.66 ± 0.67 (22)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Winter [Invierno]</td>
<td>73.2 ± 2.9 (3)</td>
<td>55.0 ± 3.0 (3)</td>
<td>25.81 ± 0.21 (3)</td>
</tr>
<tr>
<td>Juvenile [juvenil]</td>
<td>Male [Macho]</td>
<td>Autumn [Otoño]</td>
<td>75.1 ± 2.3 (68)</td>
<td>57.1 ± 2.0 (68)</td>
<td>26.35 ± 0.84 (56)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Winter [Invierno]</td>
<td>73.5 ± 1.7 (27)</td>
<td>55.7 ± 1.7 (27)</td>
<td>26.04 ± 0.65 (21)</td>
</tr>
<tr>
<td></td>
<td>Female [Hembra]</td>
<td>Autumn [Otoño]</td>
<td>72.9 ± 2.0 (43)</td>
<td>55.1 ± 1.7 (43)</td>
<td>25.96 ± 0.70 (35)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Winter [Invierno]</td>
<td>72.6 ± 1.1 (10)</td>
<td>55.0 ± 1.0 (10)</td>
<td>25.65 ± 0.85 (8)</td>
</tr>
</tbody>
</table>

*Namnetum* subspecies [Subespecie *namnetum*]

| 66.3 ± 0.7 (8) | 49.4 ± 1.5 (8) | 24.20 ± 0.73 (8) |

ANOVA results (excluding *namnetum*) [Resultados del ANOVA (subsp. *namnetum* excluida)]

<table>
<thead>
<tr>
<th></th>
<th>$F_{1, 224}$</th>
<th>$P$</th>
<th>$F_{1, 224}$</th>
<th>$P$</th>
<th>$F_{1, 180}$</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age [Edad]</td>
<td>7.59</td>
<td>0.006</td>
<td>2.36</td>
<td>0.126</td>
<td>0.26</td>
<td>0.613</td>
</tr>
<tr>
<td>Sex [Sexo]</td>
<td>33.28</td>
<td>&lt;0.001</td>
<td>29.02</td>
<td>&lt;0.001</td>
<td>11.32</td>
<td>0.001</td>
</tr>
<tr>
<td>Population [Población]</td>
<td>2.05</td>
<td>0.154</td>
<td>2.29</td>
<td>0.132</td>
<td>2.13</td>
<td>0.146</td>
</tr>
<tr>
<td>Age x Sex [Edad x Sexo]</td>
<td>4.06</td>
<td>0.045</td>
<td>3.62</td>
<td>0.058</td>
<td>0.57</td>
<td>0.449</td>
</tr>
<tr>
<td>Age x Population [Edad x Población]</td>
<td>0.79</td>
<td>0.375</td>
<td>0.17</td>
<td>0.680</td>
<td>0.76</td>
<td>0.384</td>
</tr>
<tr>
<td>Sex x Population [Sexo x Población]</td>
<td>1.92</td>
<td>0.168</td>
<td>2.66</td>
<td>0.104</td>
<td>0.53</td>
<td>0.469</td>
</tr>
<tr>
<td>Age x Sex x Population [Edad x Sexo x Población]</td>
<td>0.03</td>
<td>0.858</td>
<td>0.03</td>
<td>0.858</td>
<td>0.72</td>
<td>0.397</td>
</tr>
</tbody>
</table>

$n = 14$) and wintering populations $(0.12 \pm 0.15 \text{ g/day}, n = 3; t_{15} = 2.77, P = 0.117)$, being approximately zero. Within the non-wintering population, there were no sex or age differences in rate of weight change (Age: $t_{12} = 3.07, P = 0.019$; Sex: $t_{10} = 0.09, P = 0.773$) or in duration of the staying period (Age: $t_{14} = 2.93, P = 0.019$; Sex: $t_{12} = 0.13, P = 0.729$). The average staying period of the non-wintering population in autumn migration was $4.8 \pm 3.2 \text{ days} (n = 16)$. The standardised weight change rate gave results similar to those obtained with non-transformed rates (all analyses: $P > 0.073$).
### Table 2

Results of the comparison of fat contents and body condition indices between ages and sexes in both autumn and winter season separately (see text for more details).

<table>
<thead>
<tr>
<th></th>
<th>Autumn [Otoño]</th>
<th></th>
<th>Winter [Invierno]</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$F$</td>
<td>$P$</td>
<td>$F$</td>
<td>$P$</td>
</tr>
<tr>
<td>Fat level [Grasa]</td>
<td>$F_{1,165}$</td>
<td>0.104</td>
<td>$F_{1,42}$</td>
<td>3.512</td>
</tr>
<tr>
<td>Age [Edad]</td>
<td>1.928</td>
<td>0.167</td>
<td>0.002</td>
<td>0.969</td>
</tr>
<tr>
<td>Sex [Sexo]</td>
<td>0.082</td>
<td>0.775</td>
<td>0.100</td>
<td>0.753</td>
</tr>
<tr>
<td>Age x Sex [Edad x Sexo]</td>
<td>0.082</td>
<td>0.775</td>
<td>0.100</td>
<td>0.753</td>
</tr>
<tr>
<td>Body condition [Condición física]</td>
<td>$F_{1,163}$</td>
<td>0.439</td>
<td>$F_{1,40}$</td>
<td>0.885</td>
</tr>
<tr>
<td>Age [Edad]</td>
<td>9.461</td>
<td>0.002</td>
<td>1.561</td>
<td>0.219</td>
</tr>
<tr>
<td>Sex [Sexo]</td>
<td>0.044</td>
<td>0.835</td>
<td>3.456</td>
<td>0.070</td>
</tr>
<tr>
<td>Age x Sex [Edad x Sexo]</td>
<td>0.044</td>
<td>0.835</td>
<td>3.456</td>
<td>0.070</td>
</tr>
<tr>
<td>Covariate Fat [Covariable Grasa]</td>
<td>162.637</td>
<td>&lt;0.001</td>
<td>4.756</td>
<td>0.035</td>
</tr>
<tr>
<td>Covariate Tarsus [Covariable Tarso]</td>
<td>23.493</td>
<td>&lt;0.001</td>
<td>17.481</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

**Fig. 3.**—Body condition index (fat-free body mass relative to body size) of Bluethroats, according to age and sex for both wintering and non-wintering populations in central Spain. Mean values, with standard errors and sample sizes, are shown.

[Índice de condición física (peso magro relativo al tamaño del ave) del Pechiazul, según edades y sexos, para ambas poblaciones invernante y no invernante en el centro de España. Se muestra la media, el error estándar y el tamaño muestral.]
**DISCUSSION**

Bluethroats migrating and wintering in central Iberia come from central Europe and belonged to the *cyanecula* subspecies group, including the *namnetum* subspecies. The percentage of individuals of the latter subspecies was very similar to that found in southeastern Iberia (Peiró, 1997a). This agrees with the pattern of migration described for the species, whose south-west races (*cyanecula* and *namnetum*) move between south and west, with concentration on autumn passage in Iberia, the majority of them moving south into Africa, while the northern race (*svecica*) migrates south into Africa or south-east probably to winter in Pakistan and India (Cramp, 1988). We did not capture any individual of the *svecica* subspecies, although it has been observed in the east Spanish coast (Aymí & Martínez, 1990; Peiró, 1997a). Nevertheless, results on subspecies identification according to plumage should be interpreted carefully, especially in winter, due to the high variability of plumage colour patterns in this season (Cortés et al., 2002), although males can be separated by these criteria (Cramp, 1988).

It is possible that the breeding population of Iberian Bluethroats (Gómez-Manzaneque, 2003) -described as subspecies *azuricollis* by some authors (e.g. Zink et al., 2003)-, could migrate and winter in the area together with central European populations (Gómez-Manzaneque, 1997b), namely subspecies *cyanecula* and *namnetum*. Iberian birds leave their breeding areas in winter (Díaz et al., 1994; Gómez-Manzaneque, 1997b; Pérez-Tris, 2002), and they would undertake a short migration to nearby areas in central or southern Spain, where they could overwinter. This would agree with the hypothesis that, within species, migratory behaviour may change with latitude (Berthold, 1999), so that Iberian Bluethroats would move shorter distances than Central European birds. Unfortunately, Iberian birds cannot be separated from other populations in the hand (Swenson, 1996), and recovery data confirming this idea are lacking. Further studies about Iberian Bluethroats are needed to highlight their migration strategy and their wintering quarters.

The timing of migration was in agreement with that seen in earlier studies in the Iberian peninsula (Aragüés, 1974; Ferrer et al., 1986; Finlayson & Cortés, 1987; Grandío & Belzunce, 1987; Bueno, 1990; Peiró, 1997a), but the spring migration finished before than in the coast (Ferrer et al., 1986; Finlayson & Cortés, 1987). The high percentage of birds captured in autumn, and their short stay period, suggests that the bulk of the individuals were migrating across the study area, while only a small percentage of birds, particularly males, wintered in it. In spring the migration was scarce, as has been described for other Iberian sites (Peiró, 1997a), probably due to the higher migration speed in this season and the use of a more direct route while flying northwards (Bernis, 1966; Simms, 1985).

These results showed that there was a small wintering population of Bluethroat in Central Spain, which followed a rather consistent pattern throughout several years and has not been previously described (Bueno, 1990; Tellería et al., 1999), thus showing that the presence of this species in Central Iberia in winter is not occasional. The number of captures throughout the winter was more unpredictable, probably due to occasional flooding of the reedbed, as Bluethroat choose moister habitats in preference to drier ones (Cramp, 1988).

Trying to understand why some birds winter in Central Spain, far from their usual winter quarters in Africa and the Mediterranean area, wintering and non-wintering populations were compared. If birds coming from the breeding areas in central and north Europe were not able to reach their winter quarters in Africa, they should stop and winter in central Iberia. This could be the case for (1) less experienced, young birds, (2) small birds, whose shorter wings permit a lower flight speed and migration speed, as compared to large ones (Pennycook, 1989), and (3) birds in poorer body condition, so they cannot fly so far. As it was found that both wintering and non-wintering populations were similar in structure, biometrics and body condition, these hypotheses do not seem to explain the wintering of Bluethroat in central Spain.

Another explanation could be that Bluethroats obtain some advantages by wintering in Iberia, nearer to their breeding areas than Africa. Birds wintering in Iberia could arrive earlier in the spring migration, increasing the chances of successful reproduction (Potti & Montalvo, 1991; Aebischer et al., 1996; Lozano et al.,...
In this case, there could exist intraspecific competition in the winter quarters. The results point to this hypothesis: (1) the wintering population was composed mainly of males; (2) males arrived in the wintering area closer to the same date than females; (3) adult males showed better body condition than other birds in winter; and (4) the return rate of the wintering population was high. Also, taking into account recovery data, Hernandez et al. (2003) found for the whole Iberian Peninsula that there were more males than females, and more adults than juveniles in winter. In addition, the Bluethroat is a monogamous species and apparently territorial in winter quarters, and their breeding territories may be clumped probably due to habitat constraints (Cramp, 1988), so an early arrival of the males would be especially important to secure the best breeding territories. This agrees with the phenomenon of differential migration, with adult males remaining closest to the breeding grounds, young males and adult females moving on further, and the youngest females moving furthest away (Bertold, 2001).

Bluethroat biometrics found in central Spain was similar to those obtained in other cyanecula and namnetum populations (Cramp, 1988; Peiró, 1997a; Eybert et al., 1999; García et al., 2000). Differences according to age have been previously explained for other passerines (Altalo et al., 1984; Pérez-Tris & Tellería, 2001 and references included there). Males were bigger than females, probably because the former are more dominant than the latter, as had been previously shown (Cramp, 1988). Males had also proportionally longer wings than females while controlling for the bird size. Proportionately longer wings reduce the energy loss and favour long-duration flights (Pennycuick, 1989), which will be advantageous in males, because they are hard-pressed to arrive early to the reproduction areas for settling the breeding territories (Cramp, 1988; Potti, 1998). These results are in accordance with the age- and sex-related differences found in the wing shape of Bluethroats in South-eastern Spain (Peiró, 1997b).

Judging by the fattening rates in the autumn passage, birds making stopover in the study area seemed not to increase their weight, as also reported for other sites of the Iberian Peninsula (Grandío & Belzunce, 1987). Differences were not found between ages or sexes, probably due to small sample sizes, while a different strategy in relation to age was found in Scandinavian Bluethroats, the adults being regarded as more efficient migrators (Ellegren, 1991). The rate at which energy stores are accumulated at stopover sites largely determines the strategy of migration, the overall migration speed, and its success (Alerstam & Lindström, 1990; Schaub & Jenni, 2000). Birds can choose to put up small fat reserves and fly short distances at a time, or to get fat largely and carry out the migration in one or two long flights (Piersma, 1987). Red-Spotted Bluethroats (Luscinia s. svecica) have been described as migrating in short flights during the autumn migration, the adults migrating significantly faster than juveniles during the first part of the migration (Ellegren, 1990), and dominance (acting through differences in size) was found to influence fat deposition rates, which may be important for the spatial and temporal pattern of migration in birds (Lindström et al., 1990). White-Spotted Bluethroats seemed to follow a similar strategy, migrating in short flights so birds do not get much fat, but more detailed studies are needed to corroborate this.

In conclusion, a part of the central and northern European population of Bluethroats winters in central Spain and has followed a rather consistent pattern throughout the years. This phenomenon of expansion of the wintering distribution in Iberia appears to be quite recent and could be associated with the general expansion of the cyanecula subspecies breeding range in Europe since 1970, a trend which still continues (De Cornulier et al., 1997; Meijer & Štastny, 1997; Eybert et al., 1999), and could have increased intraspecific competition for breeding territories.

Acknowledgements.—We are most grateful to all ringers and assistants of SEO-Monticola ringing group who have participated in fieldwork at Las Minas Ringing Station over the eight years of this study, specially Javier Seoane and Rubén Moreno-Opo. San Martín de la Vega Town Council, Sureste de Madrid Regional Park, and Consejería de Medio Ambiente de la Comunidad de Madrid allowed us to work in Las Minas reedbed. SEO/BirdLife, Universidad Autónoma de Madrid, and Iberdrola financed part of the equipment of the Ringing Station. The manuscript greatly benefited from comments by J.
Pérez-Tris, J. Potti, G. Blanco, A. Barbosa, and an anonymous referee. Financial support to A. B. was provided by a F.P.U. grant.

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*Ardeola* 51(2), 2004, 285-296


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[Recibido: 11-12-03]
[Aceptado: 27-05-04]