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Biometric differences among the Dipper *Cinclus cinclus* populations of Spain

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Abstract. The length of the tarsus and wing, and the weight of the Dipper were measured in four mountain ranges in Spain (Cantabrian Mountains, western Pyrenees, the Central Mountains and Sierra Nevada). Birds from the Sierra Nevada were the largest but there were no significant differences among the other three areas. In the north, the range of the *C. c. cinclus* and *C. c. aquaticus* subspecies overlapped. In the south only *aquaticus* was present and in the central mountains only *cinclus*. The biometrics of *cinclus* in the north and centre were similar but *aquaticus* was larger in the south than the north. Spanish populations of *C. cinclus* thus appear to go against the predictions of Bergmann's rule. The residual index (RI) was calculated for individual birds from the regression of mass/tarsus length. RI was higher in males than females in the northern populations, but the same in the centre and south. According to this index, males (but not females) were heavier than the theoretical weight in the north and lighter in the centre and southern ranges. Some other variations in the Spanish populations are also discussed.

Key words: Dipper, *Cinclus cinclus*, biometry, metric traits, residual body mass, Spain

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INTRODUCTION

In Spain, the Dipper is distributed along rivers in northern mountain ranges, especially in the Pyrenees and Cantabria (almost continuously from east to west) and in the centre and south (with very fragmented populations; López et al. 2003). Non-local recaptures are rare (Pinilla et al. 2003), which suggests little displacement or isolation between populations. There are two subspecies in Spain, *C. c. cinclus* in the north and west and *C. c. aquaticus* in the east and south (Tellería et al. 1999).

The biometry of the Dipper has been well studied in several European countries (e.g. Galbraith & Broadley 1980, Rockenbauch 1985, Schmid & Spitznagel 1985, Ormerod et al. 1986, Marzolin 1990, O'Halloran et al. 1992, Robert 1992, Tasinazzo et al. 2000). However, only a few studies have been carried out in Spain with few samples in relatively small areas (Marsá 1988, Esteban et al. 2000, Villarán et al. 2001). As with other birds, biometric studies can be useful to better understand the distribution and biology of the Dipper and improve conservation efforts (Zink & Remsen 1986, Tellería & Carbonell 1999).

The body condition score has not been used for Dippers in Spain so far. Since survival rate increases with body weight, and weight varies with size, it is important to know whether an individual is above or below the weight that corresponds to its size (a high or low body condition score; Lindstedt & Calder 1976, Saether 1989).

In this study the wing and tarsus length of Dippers in terms of age, subspecies and geographic area were analyzed. The key objectives of the paper are 1) to find possible differences between subspecies, 2) to apply biometric body condition scores to compare different populations. The aim of this was to study the conservation status of different populations. Because in southern Spain Dippers are very scarce (Pleguezuelos 1992), it is important to detect populations with a decreasing survival rate.

STUDY AREA AND METHODS

We sampled four mountainous areas in Spain (Fig. 1) between 1999–2003, including the Cantabrian Mountains (river Curueno in León province), the western Pyrenees (rivers Arga, Erro, Marín, Mediano and Artesiaga, all of them in Navarra province), the Central Mountains (river Cuerpo de Hombre in Salamanca province, and river Ambroz in Cáceres province) and the Sierra Nevada Mountains (rivers Maitena, Monachil and Genil, all of them in Granada province). Dippers were captured with mist nets and banded for individual identification. The data on recaptures was not included in the statistical analysis.

The wing length (maximum span) was measured with a precision ruler (0.5 mm) and tarsus length (see Svensson 1992), with callipers (0.1 mm). Wing length was not included if birds were moulting. Wing length is a good index of body size (Wyllie & Newton 1994, Wiklund 1996) and, since tarsus length has been measured in other studies, we could compare it among different populations. Birds were weighed with a precision scale (0.1 g). Since weight may change during the year (Ormerod et al. 1986, Bryant & Tatner 1988, O'Halloran et al. 1992, Esteban et al. 2000) we only used data from June to October. Age was measured as in Svensson (1992). Birds were grouped into juveniles (first breeding season) and adults (after at least one breeding season). March 1st was considered as the beginning of the breeding season. The colour of the breast feathers was used to differentiate between subspecies (dark brown for *cinclus* and brownish-red for *aquaticus*) but only in individuals that had already moulted once.

A small blood sample (< 0.1 ml) was taken from the brachial vein of all individuals for sexing by molecular techniques, as described by Griffiths et al. (1998) and Gutiérrez-Corchero et al. (2002).

Data analysis

Most statistical analyses were carried out using the SPSS statistical package. The level of significance was $p < 0.05$. To compare biometric measurements we adjusted a multivariate general linear model (GLM) where the response variables were wing and tarsus length and the explanatory variables (factors) were geographic area, sex and age, and their interactions. To determine the significance of the factors and their interactions we used the Hotelling trace, a statistical multivariate test on the between-subjects effects for

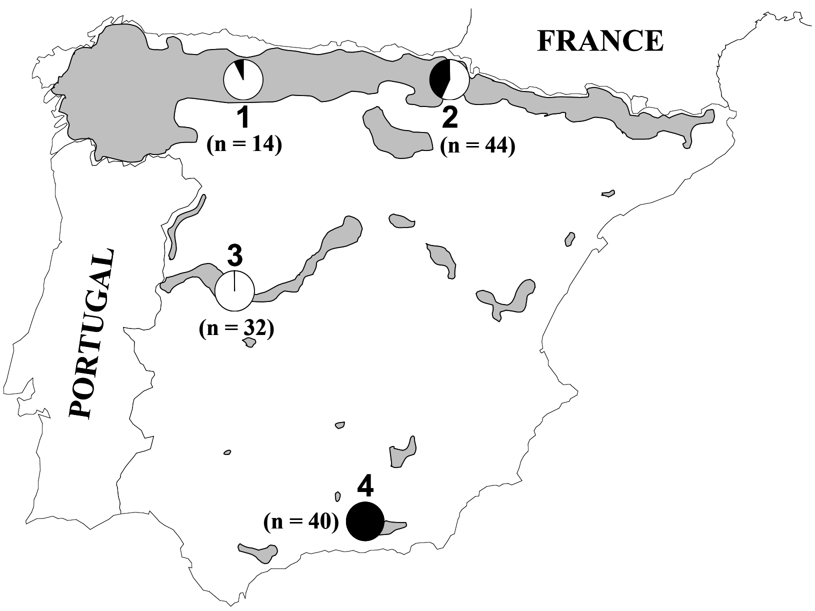

Fig. 1. Distribution of the breeding population of Dippers in Spain (shaded area) and the study areas: 1. Cantabrian Mountains, 2. Western Pyrenees, 3. Central Mountains, 4. Sierra Nevada Mountains. Circles are the percentage of *cinclus* (white) and *aquaticus* (black) subspecies in samples collected. n — sample size.

analysing whether there are significant differences or not for an ANOVA with repeated measurements (Arnold 1981).

The only significant main effects were sex ($p < 0.001$) and area ($p < 0.001$), but not age ($p = 0.97$). Because no interactions were significant, we performed a univariate analysis. Tarsus and wing length followed a normal distribution, according to the Kolmogorov-Smirnov test, except tarsus length in female *aquaticus* from Sierra Nevada Mountains. The mean values of each measurement were analysed using a t-test for independent sampling with equal or unequal variances depending on the Levene contrast. Results were also confirmed using a non-parametric Mann-Whitney U-test for small sample sizes. Biometric measurements in the four sampling areas were compared by ANOVA and a post-hoc contrast using the Scheffé test, grouping all sexes and ages. Similar analyses were carried out to compare the subspecies.

The residual index RI was used to verify the body condition score of each bird (Jacob et al. 1996), based on the regression of bird weight versus body size. A positive value indicated that the bird weight was higher than expected for its size, and vice versa. To find the body size with the best fit, two regressions were made for the weight versus the length of the wing and weight versus the length of the tarsus, as in other studies (e.g., Ormerod & Tyler 1990), with a logarithmic transformation recommended by Jacob et al. (1996) and Kotiaho (1999). The regression analysis of log weight on log wing length (or log tarsus length), sex and age, excluded age from the analysis using the stepwise method ($p = 0.38$ and $p = 0.33$ for wing and tarsus, respectively). Later we performed an analysis of covariance (ANCOVA). The differences between the slopes of regression lines for males and females were not significant ($p = 0.94$ for wing and $p = 0.19$ for tarsus), but the two lines were significantly different ($p < 0.001$ in both cases tarsus and wing). Wing length instead of tarsus length helped to better discriminate between models in the ANCOVA. Thus, we decided to calculate the residual index with log wing length with different lines for the two sexes. After the comments by Green (2001) we contrasted the linear adjustment, obtaining a sampling significance of $p < 0.001$ and a multiple linear correlation of $R = 0.826$, that guaranteed the validity of the indices of body condition calculated directly with the ordinary minimum squares (OLS).

RESULTS

In total 197 Dippers were captured, 30 from the Cantabrian Mountains (20 males, 10 females), 95 from the western Pyrenees (45 males, 50 females), 32 from the Central Mountains (15 males, 17 females) and 40 from the Sierra Nevada Mountains (18 males, 22 females). In total, 98 were juvenile (46 males, 52 females) and 99 adults (52 males, 47 females).

Tarsus and wing lengths did not differ significantly ($p > 0.05$) among juveniles and adults within each sex. The length of the tarsus and wing were larger in males than in females in all areas (Table 1).

Table 1. Mean length (± SE) of the tarsus and wing (mm) of male and female Dippers in the four study areas, including t-test statistics and p-values (p) (range of values in brackets). N — sample size.

Study area		Males	N	Females	N	
Cantabrian Mountains	Tarsus	29.82 ± 0.18 (27.96–31.16)	20	28.35 ± 0.26 (27.21–29.63)	10	$t_{28} = 4.53$ $p < 0.001$
	Wing	92.55 ± 0.57 (88.0–97.5)	19	84.38 ± 0.33 (82.5–85.5)	9	$t_{26} = 12.29$ $p < 0.001$
Western Pyrenees	Tarsus	29.65 ± 0.14 (25.34–30.98)	45	28.11 ± 0.11 (26.11–29.57)	49	$t_{92} = 8.44$ $p < 0.001$
	Wing	92.47 ± 0.41 (87.5–99.5)	44	84.61 ± 0.29 (79.5–90.0)	49	$t_{91} = 15.41$ $p < 0.001$
Central Mountains	Tarsus	29.74 ± 0.16 (28.22–31.24)	15	28.27 ± 0.09 (27.60–28.89)	17	$t_{30} = 7.93$ $p < 0.001$
	Wing	93.16 ± 0.43 (90.0–95.0)	15	85.05 ± 0.39 (81.0–89.0)	17	$t_{30} = 13.85$ $p < 0.001$
Sierra Nevada Mountains	Tarsus	30.48 ± 0.14 (29.33–31.53)	18	29.24 ± 0.55 (27.00–30.00)	19	$t_{35} = 7.15$ $p < 0.001$
	Wing	96.22 ± 0.51 (93.0–101.0)	18	88.79 ± 0.39 (85.5–92.0)	22	$t_{38} = 11.61$ $p < 0.001$

Table 2. Post hoc Scheffé test p-values for tarsus and wing length as response variables.

Study areas		Western Pyrenees	Central Mountains	Sierra Nevada Mountains
Cantabrian Mountains	Tarsus	0.37	0.79	0.12
	Wing	0.10	0.66	< 0.001
Western Pyrenees	Tarsus		0.92	< 0.001
	Wing		0.68	< 0.001
Central Mountains	Tarsus			0.004
	Wing			< 0.001

The two groups of Dippers could be distinguished — one that included the Cantabrian Mountains, the western Pyreness and the Central Mountains (with no significant differences among them in the two measurements), and the second from the Sierra Nevada Mountains. Birds from the Sierra Nevada had significantly longer tarsi and wing lengths than other areas, except for tarsi from the Cantabrian Moutains (Table 2).

In the Sierra Nevada Mountains, all banded Dippers belonged to the *aquaticus* subspecies and in the Central Mountains to the *cinclus* subspecies (Fig. 1). In the western Pyrenees 55% of the birds were *aquaticus*, compared with only 7% in the Cantabrian Mountains. The tarsus lengths of the *cinclus* and *aquaticus* birds captured in the north (Cantabrian Mountains and western Pyrenees) were not significantly different (t_{31} = 0.19 and t_{22} = 0.35, for males and females, respectively) nor were the wing lengths (t_{29} = 1.62 and t_{21} = 0.80). There were no significant differences between northern and central areas for *cinclus*, while *aquaticus* from the south had a larger tarsus (only males) and wing length (males and females) than the north (Table 3).

Equation for the linear regression of weight on wing (both variables in ln transformations) for males and females was $y = e^{0.550}x^{0.796}$, $y = e^{0.437}x^{0.796}$, respectively (y: weight of bird in g; x: length of wing in mm, Fig. 2). Thus, the allometric exponent was 0.796. The residuals in both adjustments for males and females provide a body condition index that was used later to compare the four sampling areas.

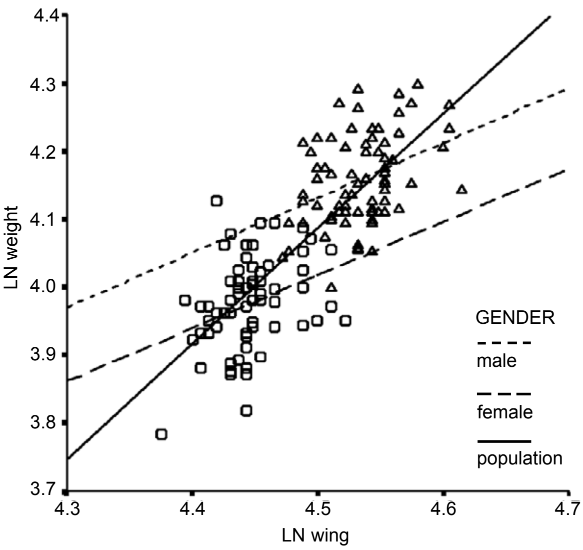

Fig. 2. Linear regression of the logarithm of the weight versus the logarithm of the wing length for males and females and for the total population.

Table 3. Tarsus and wing tail length mean values (± SE) in Dippers, according to sex, subspecies (*aquaticus*, *cinclus*) and sampling area (North: Cantabrian Mountains + Western Pyrenees, South: Sierra Nevada Mountains; Centre: Central Mountains). Differences tested by t-test, * — p < 0.05, ** — p < 0.02, *** — p < 0.001, ns — p > 0.05, M — males, F — females.

Sex	Measurement	Subspecies					
		aquaticus			*cinclus*		
		North	South		North	Centre	
M	Tarsus	29.37 ± 0.26 (9)	30.48 ± 0.14 (18)	**	29.81 ± 0.23 (24)	29.74 ± 0.16 (15)	ns
	Wing	91.22 ± 1.25 (9)	96.22 ± 0.51 (18)	***	93.00 ± 0.49 (22)	93.16 ± 0.43 (15)	ns
F	Tarsus	28.26 ± 0.29 (10)	29.24 ± 0.55 (20)	ns	28.13 ± 0.21 (14)	28.27 ± 0.09 (20)	ns
	Wing	86.00 ± 0.78 (10)	88.79 ± 0.39 (22)	***	85.34 ± 0.39 (13)	85.02 ± 0.39 (17)	ns

Table 4. Mean (± SE) values of residual index in males, females, adult and yearling Dippers according to the study area. In brackets — sample size. Differences tested by t-test, * — p < 0.05, ns — p > 0.05.

Study area	Sex			Age		
	Males	Females		Adults	Yearlings	
Cantabrian Mountains	2.40 ± 0.99 (19)	1.28 ± 1.34 (9)	ns	2.73 ± 1.16 (17)	0.97 ± 0.87 (11)	ns
Western Pyrenees	0.34 ± 0.58 (34)	0.56 ± 0.54 (38)	ns	-0.26 ± 0.66 (36)	1.18 ± 0.40 (36)	ns
Central Mountains	-3.56 ± 0.51 (13)	-1.66 ± 0.65 (15)	*	-2.72 ± 0.60 (15)	-2.34 ± 0.71 (13)	ns
Sierra Nevada Mountains	-0.18 ± 1.06 (11)	-0.07 ± 0.89 (10)	ns	-0.04 ± 0.81 (17)	-0.50 ± 1.12 (4)	ns

The mean value of the residual index RI only differed significantly between sexes in the Central Mountains (Table 4), where it was higher in males than females. It did not differ significantly in term of age in any of the sampling areas (Table 4).

In the Cantabrian Mountains and western Pyrenees the males were heavier than expected for their size (Table 4), without significant differences between areas (p = 0.25, Scheffé test). In the Central Mountains and Sierra Nevada Mountains, males were lighter than expected, without significant differences between areas (p = 0.14, Scheffé test). In females there were no significant differences in the mean RI in the sampled areas (ANOVA, F = 2.182, p = 0.10).

DISCUSSION

As in other studies on Dipper in Spain (Esteban et al. 2000, Villarán et al. 2001), there were no significant differences among juveniles and adults in metric traits. In some European countries wing length is a precise criterion to sex Dippers (Svensson 1992), but not in Spain (Campos et al. 2005). Probably the great overlap in biometric characters in males and females as well as the large differences among geographic areas are the cause of this.

Dippers in the Sierra Nevada Mountains were larger than in other areas. Possibly the geographic isolation of this population (Fig. 1) and the unique environmental conditions of the mountains in the south (the highest in Spain), have favoured evolution towards a larger size. Dippers from the Atlas Mountains (Morocco), about 500 km south, are significantly larger than from the Sierra Nevada Mountains (t_{25} = 7.585, p < 0.001; 102.8 mm wing and 36.1 mm tarsus; Tyler & Ormerod 1991). So, in Spain the size of Dippers increases towards the east and towards the southern border in its area of distribution.

Bergmann's rule states that body size varies inversely with ambient temperature, so that body size increased with latitude. Our data confirm the findings by Esteban et al. (2000) that the Spanish Dipper populations do not follow Bergmann's rule, which works in most species of non-migratory birds (Ashton 2002, Mieri & Dayan 2003). Species that are always present in the same area would be more affected by climatic factors than those that avoid winter cold by emigrating to other areas. The Dipper can change altitudes (Bernis 1971), descending to lower, warmer areas in winter. This could be why the biometrics of Spanish populations are opposite to what would be expected by the Bergmann's rule.

The biometric measurements used could not differentiate between subspecies, so genetic characterisation is required. On the other hand, the body condition of Dippers (measured by the residual index) only varied with geographic area not with sex (except in the Central Mountains) or age. This suggests that the environmental conditions (for example, habitat quality) should have a notable influence on body weight. Birds had a better body condition score in Cantabrian Mountains where there was also a high density of Dippers along the river (8.1 birds km^{-1} in summer, pers. obs.), much higher than the Central Mountains in the same season (4.0 birds km^{-1}, Peris et al. 1991), where few rivers are occupied by this species.

In northern Spain, the RI values were about zero, which suggests that it is the best area. The weight of Dippers from the Sierra Nevada Mountains was close to the theoretical weight despite a larger body size, which suggests that they are well adapted to the characteristics of the rivers there.

The Dippers in the Central Mountains had the lowest body condition, especially males. Males defend the territories, which reduces mobility, while females tend to disperse to better quality territories (Marzolin 2002), which probably means that they can gain weight and have a higher RI than males.

Saether (1989) proposed a relationship between survival and body size. We applied this relationship to our data — mean weight for males 64.1 g and 53.3 g for females — so that an adult survival rate of 0.55 for males and 0.54 for females could be calculated. In the areas where Dippers have a lower body condition score (i.e., where weight decreases), survival rate will also decrease (Hunter et al. 1984). This can cause greater dispersion and decrease the population size (Fuller et al. 1995). This may explain why the population of Dippers in the Central Mountains is so low and that few rivers are occupied.

The fact that there are populations with different biometrics in Spain, suggests the need to test whether the differences have genetic components. This is especially important in the case of isolated populations such as in the Sierra Nevada Mountains.

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REFERENCES

Arnold S. F. 1981. The Theory of Linear Models and Multivariate Analysis. New York.

Ashton K. G. 2002. Patterns of within-species body size variation of birds: strong evidence for Bergmann's rule. Global Ecol. & Biogeogr. 11: 505–523.

Bernis F. 1971. [Iberian migratory birds]. Vol. VII–VIII. Madrid.

Bryant D. M., Tatner P. 1988. Energetics of the annual cycle of Dippers *Cinclus cinclus*. Ibis 130: 17–38.

Campos F., Gutiérrez-Corchero F., López-Fidalgo J., Hernández M. 2005. [A more accurate criterion to sex European Dippers from the Iberian Peninsula based on biometric data]. Revista Catalana d'Ornitologia 20 (in press).

Esteban L., Campos F., Ariño A. H. 2000. Biometrics amongst Dippers *Cinclus cinclus* in the north of Spain. Ringing & Migration 20: 9–14.

Fuller R. J., Gregory R. D., Gibbons D. W., Marchant J. H., Wilson J. D., Baillie S. R., Carter N. 1995. Population declines and range concentrations among lowland farmland birds in Britain. Conserv. Biol. 9: 1425–1441.

Galbrait H., Broadley B. 1980. Biometrics and sexing of the British race of the Dipper. Ringing & Migration 3: 62–64.

Green A. J. 2001. Mass/length residual: measures of body condition or generators of spurious results? Ecology 85: 1473–1483.

Griffiths R., Double M. C., Orr K., Dawson R. J. G. 1998. A DNA test to sex most birds. Mol. Ecol. 7: 1071–1075.

Gutiérrez-Corchero F., Arruga M. V., Sanz L., García C., Hernández M. A., Campos F. 2002. Using FTA cards to store avian blood samples for genetic studies. Their application in sex determination. Mol. Ecol. Notes 2: 75–77.

Hunter M. L., Withan J. W., Dow H. 1984. Effects of a carbaryl induced depression in invertebrate abundance on the growth and behaviour of American Black Duck and Mallard Ducklings. Can. J. Zool. 62: 452–456.

Jacob E. M., Marshall S. D., Uetz G. W. 1996. Estimating fitness: a comparison of body condition indices. Oikos 77: 61–67.

Kotiaho J. S. 1999. Estimating fitness: comparison of body condition indices revisited. Oikos 87: 399–400.

Lindstedt S. L., Calder W. A. 1976. Body size and longevity in birds. Condor 78: 91–94.

López V., Vázquez X., Gómez-Serrano M. A. 2003. [Dipper, *Cinclus cinclus*]. In: Martí R., Del Moral J. C. (eds). Atlas de las Aves Reproductoras de España. Madrid, pp. 406–407.

Marsá J. 1988. [Wing length and sex of *Cinclus cinclus* pyrenaicus]. Bull. GCA 5: 1–8.

Marzolin G. 1990. Variabilité morphométrique du cincle plongeur *Cinclus cinclus* en fonction du sexe et l'age. Alauda 58: 85–94.

Marzolin G. 2002: Influence of the mating system of the Eurasian Dipper on sex-specific local survival rates. J. Wildl. Manage. 66: 1023–1030.

Meiri S., Dayan T. 2003. On the validity of Bergmann's rule. J. Biogeogr. 30: 331–351.

O'Halloran J., Smiddy P., O'Mahony B. 1992. Biometrics, growth and sex ratios amongst Irish Dipper *Cinclus cinclus hibernicus*. Ringing & Migration 13: 152–161.

Ormerod S. J., Tyler S. J. 1990. Assessments of body condition in Dippers *Cinclus cinclus*: potential pitfalls in the derivation and use of condition indices based on body proportions. Ringing & Migration 11: 31–41.

Ormerod S. J., Tyler S. J., Lewis J. M. S. 1986. Biometrics, growth and sex ratios amongst Welsh Dippers *Cinclus cinclus*. Ringing & Migration 7: 61–70.

Peris S., González-Sánchez N., Carnero J. I., Velasco J. C., Masa A. I. 1991. [Some factors affecting numbers of Dippers in the western-central Iberian Peninsula]. Ardeola 38: 11–20.

Pinilla J., Frías O., Moreno-Opo R., Gómez-Manzaneque A., Hernández-Carrasquilla F. 2003. [Report from the ringing activities of the ICONA Central Ringing Office. Year 2002]. Ecología 17: 343–373.

Pleguezuelos J. M. 1992. [Breeding birds of eastern Betic Mountains and Guadix, Baza and Granada basins]. Universidad de Granada. Granada.

Robert H. 1992. Morphometric parameters and sex differentiation of Dipper (*Cinclus cinclus*) populations of Hungary. Aquila 99: 111–118.

Rockenbauch D. 1985. Geschlechts-und Altersbestimmung bei der Wasseramsel (*Cinclus cinclus aquaticus*). Okol. Vögel 7: 363–377.

Saether B. E. 1989. Survival rates in relation to body weight in European birds. Ornis Scand. 20: 13–21.

Schmid W., Spitznagel A. 1985. Der sexuelle Größsendimorphismus süddeutscher Wasseramseln (*Cinclus c.*

aquaticus): Biometrie, Funktion und mögliche Ursachen. Okol. Vögel 7: 379–408.
Svensson L. 1992. Identification Guide to European Passerines. Stockholm.
Tasinazzo S., Fracasso G., Faccin F. 2000. Adult biometrics and nestling growth in a southern Prealpine Dipper *Cinclus cinclus* population. Avocetta 24: 39–44.
Tellería J. L., Asensio B., Díaz M. 1999. [Iberian Birds]. Vol. II. Passerines. Madrid.
Tellería J. L., Carbonell R. 1999. Morphometric variation of five Iberian Blackcap *Sylvia atricapilla* populations. J. Avian Biol. 30: 63–71.
Tyler S. J., Ormerod S. J. 1991. Aspects of the biology of Dippers *Cinclus cinclus minor* in the Atlas Mountains of Morocco outside the breeding season. Bonn. Zool. Beitr. 42: 35–45.
Villarán A., Pascual-Parra J., Mezquida E. T. 2001. [Biometrics differences between two Dipper *Cinclus cinclus* populations in both slopes of Sistema Central saws]. Bull. GCA 18: 9–16.
Wiklund C. G. 1996. Body length and wing length provide univariate estimates of overall body size in the merlin. Condor 98: 581–588.
Wyllie I., Newton I. 1994. Latitudinal variation in the body-size of Sparrowhawks *Accipiter nisus* within Britain. Ibis 136: 434–440.
Zink R. M., Remsen J. V. 1986. Evolutionary process and patterns of geographic variation in birds. Current Ornithol. 4: 1–69.

STRESZCZENIE

[Różnice biometryczne populacji pluszczy w Hiszpanii]

W 1999–2003 przeprowadzono pomiary długości skoku i skrzydła oraz ciężaru ciała 197 pluszczy (należących do dwóch podgatunków: nominatywnego i *C. c. aquaticus*) pochodzących z czterech górskich rejonów Hiszpanii (Fig. 1). Wszystkie osobniki klasyfikowano jako młode (w drugim roku) bądź dojrzałe (przynajmniej w trzecim roku). Kondycję ptaków określono wartością wskaźnika RI będącym wartością resztową z regresji ciężaru ciała na długość skoku. Płeć oznaczano na podstawie badań genetycznych próbek krwi pobranej z żyły skrzydłowej.

W górach Sierra Nevada wszystkie osobniki należały do podgatunku *aquaticus*, w Górach Centralnych — do podgatunku nominatywnego (Fig. 1). W zachodnich Pirenejach 55% pluszczy należało do podgatunku *aquaticus*, zaś w górach Kantabryjskich — zaledwie 7%. Długość skoku i skrzydła nie różniły się u młodych i dojrzałych osobników. Oba te parametry osiągały większe wartości u samców (Tab. 1). Ptaki pochodzące z gór Sierra Nevada miały istotnie dłuższe skoki i skrzydła w porównaniu z osobnikami schwytanymi na pozostałych powierzchniach (z wyłączeniem danych dla skoku ptaków z Gór Kantabryjskich) (Tab. 2). Pomiary wykazały, że ptaki z podgatunku *cinclus* pochodzące z północy i centrum były podobnej wielkości, podczas gdy pluszcze należące do podgatunku *aquaticus* schwytane na południu były większe od ptaków pochodzących z północy (Tab. 3). Wartość współczynnika RI wykazywała istotne różnice jedynie w przypadku samców i samic z Gór Kantabryjskich (Tab. 4). Samce schwytane tam oraz w zachodnich Pirenejach były cięższe niż wynikałoby to z ich rozmiarów, natomiast samce z Gór Centralnych i Sierra Nevada były lżejsze niż się spodziewano. Wyniki uzyskane podczas badań wskazują, że hiszpańskie populacje pluszczy wykazują cechy odwrotne do przewidywań reguły Bergmanna (zwiększanie rozmiarów ciała wraz z rosnącą szerokością geograficzną).

24TH INTERNATIONAL ORNITHOLOGICAL CONGRESS

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