SUPPLEMENTARY ELECTRONIC MATERIAL

ARDEOLA 67(2)

AGE-RELATED VARIATION IN WING SHAPE DIFFERS BETWEEN BIRD ORDERS: IMPLICATIONS FOR INTERPRETATION OF THE POINTEDNESS INDEX (C2 AXIS) IN A SIZE-CONSTRAINED PRINCIPAL COMPONENT ANALYSIS (SCCA)

LA VARIACIÓN DE LA FORMA DEL ALA ASOCIADA CON LA EDAD DIFIERE ENTRE ÓRDENES DE AVES: IMPLICACIONES PARA LA INTERPRETACIÓN DEL ÍNDICE DE APUNTAMIENTO (EJE C2) EN UN 'SIZE CONSTRAINED COMPONENTS ANALYSIS' (SCCA)

Xabier CABODEVILLA[1, 2, 4, *], Javier PÉREZ-TRIS[3], Lara MORENO-ZARATE[2], Antón PÉREZ-RODRÍGUEZ[3], José Francisco LIMA-BARBERO[2, 5], María Cruz CAMACHO[2], Diego VILLANUA[4], Rubén IBÁÑEZ[4], Andrea GERBOLES[4] and Beatriz ARROYO[2]

[1] Department of Zoology and Animal Cell Biology, Faculty of Pharmacy, University of the Basque Country (UPV/EHU), Paseo de la Universidad 7, 01006 Vitoria-Gasteiz, Alava, Spain.

[2] Instituto de Investigación en Recursos Cinegéticos (IREC) (CSIC-UCLM-JCCM), Ronda de Toledo 12, 13005 Ciudad Real, Spain.

[3] Department of Biodiversity, Ecology and Evolution, Faculty of Biology, Universidad Complutense de Madrid (UCM), Madrid, Spain.

[4] Department of Ornithology, Aranzadi Sciences Society, Zorroagagaina 11, 20014 Donostia, Spain.

[5] Sabiotec Spinoff, Ed. Polivalente UCLM, Camino de Moledores, 13005 Ciudad Real, Spain.

* Corresponding author: xabier.cabodevilla@ehu.eus

Appendix 1.

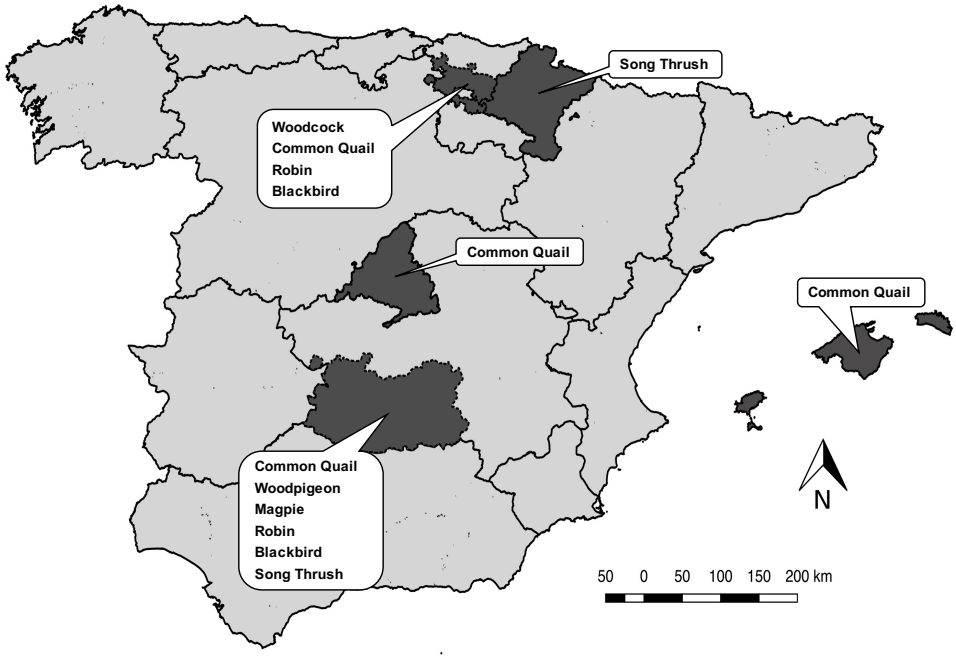

Figure A1: Locations of sampling regions for species.

Figura A1: *Localización de las regiones de estudio para las especies analizadas.*

Figure A2: Simulation of wing morphology change during the first complete moult. The purple polygon represents an adult wing tip and yellow polygon a juvenile wing tip. Top row non-passerines; Turtle Dove top right and Quail top left. Bottom row passerines; Robin bottom left and Magpie bottom right.

Figura A2: *Simulación del cambio de la morfología alar durante la primera muda completa. El polígono morado representa la punta del ala adulta y el amarillo la punta del ala juvenil. Arriba dos no paseriformes; a la izquierda tórtola europea y a la derecha codorniz. Abajo dos paseriformes; a la izquierda petirrojo y a la derecha urraca.*

Appendix 2. Model summaries.

TABLE B1

Tables with the results of SCCA analyses of the primary feathers for each species.
[Tablas con los resultados del análisis SCCA de las plumas primarias de cada especie.]

Woodcock	C1	C2	C3
P10	0.369	0.527	-0.288
P9	0.368	0.399	-0.070
P8	0.385	0.237	0.007
P7	0.367	0.055	0.280
P6	0.326	-0.182	0.695
P5	0.342	-0.316	-0.016
P4	0.339	-0.376	0.001
P3	0.329	-0.480	-0.592
P2	0.369	0.527	-0.288
% total variance explained	**83.17**	**9.69**	**2.77**
% shape variance explained		**57.55**	**16.44**

Quail	C1	C2	C3
P10	0.374	0.432	-0.399
P9	0.389	0.363	-0.186
P8	0.424	0.404	0.234
P7	0.358	-0.066	0.764
P6	0.331	-0.300	0.140
P5	0.315	-0.341	-0.144
P4	0.307	-0.358	-0.303
P3	0.314	-0.424	-0.188
% total variance explained	**72.23**	**14.28**	**5.49**
% shape variance explained		**51.43**	**19.77**

Woodpigeon	C1	C2	C3
P10	0.520	0.699	-0.485
P9	0.487	0.134	0.623
P8	0.456	-0.141	0.377
P7	0.391	-0.436	-0.139
P6	0.364	-0.533	-0.464
% total variance explained	**79.86**	**17.78**	**1.53**
% shape variance explained		**88.26**	**7.59**

Turtle Dove	C1	C2	C3
P10	0.396	0.633	-0.244
P9	0.392	0.407	0.073
P8	0.372	0.158	0.311
P7	0.332	-0.221	0.500
P6	0.332	-0.293	0.321
P5	0.327	-0.327	0.006
P4	0.330	-0.311	-0.581
P3	0.338	-0.265	-0.384
% total variance explained	**92.67**	**4.66**	**1.06**
% shape variance explained		**63.67**	**14.44**

Magpie	C1	C2	C3
P9	0.330	0.814	0.428
P8	0.350	0.218	-0.314
P7	0.346	0.096	-0.452
P6	0.358	-0.023	-0.389
P5	0.360	-0.159	-0.204
P4	0.367	-0.260	0.179
P3	0.363	-0.278	0.378
P2	0.352	-0.332	0.383
% total variance explained	**89.68**	**6.20**	**1.80**
% shape variance explained		**60.07**	**17.41**

Robin	C1	C2	C3
P9	0.351	0.542	0.301
P8	0.372	0.304	0.046
P7	0.342	0.391	-0.064
P6	0.368	0.023	-0.169
P5	0.345	-0.176	-0.264
P4	0.382	-0.320	-0.405
P3	0.305	-0.452	0.794
P2	0.357	-0.350	-0.098
% total variance explained	**74.84**	**9.13**	**6.40**
% shape variance explained		**36.29**	**25.45**

Blackbird	C1	C2	C3
P9	0.327	0.520	0.407
P8	0.347	0.391	-0.005
P7	0.349	0.311	-0.097
P6	0.347	0.155	-0.405
P5	0.376	-0.157	-0.365
P4	0.345	-0.380	-0.392
P3	0.365	-0.389	0.379
P2	0.370	-0.367	0.479
% total variance explained	**80.81**	**11.18**	**3.03**
% shape variance explained		**58.27**	**15.78**

Song Thrush	C1	C2	C3
P9	0.359	0.496	0.427
P8	0.373	0.240	0.238
P7	0.377	0.343	-0.096
P6	0.360	0.189	-0.439
P5	0.356	-0.139	-0.610
P4	0.342	-0.358	-0.063
P3	0.339	-0.439	0.207
P2	0.320	-0.450	0.376
% total variance explained	**79.05**	**10.22**	**4.41**
% shape variance explained		**48.76**	**21.04**

TABLE B2

Statistics values of GLM Analysis of primary feather length of each species. We included parameter estimate of body size, but not for each feather, age and interaction; these are included on the graphs.

[Tablas con los valores estadísticos de los análisis GLM de la longitud de las primarias para cada especie. Incluimos el coeficiente de tamaño corporal.]

Woodcock	***Degrees of freedom***	***F***	***P***	**beta**
Feather	7, 415	216.99	< 0.001	
Age	1, 415	0.01	= 0.94	
Feather x age	7, 415	1.96	= 0.06	
Wing size (forearm)	1, 415	10.47	< 0.01	0.34

Quail	***Degrees of freedom***	***F***	***P***	**beta**
Feather	7, 323	299.23	< 0.001	
Age	1, 323	0.14	= 0.70	
Feather x age	7, 323	0.76	= 0.62	
Wing size (NF)	1, 323	4.62	< 0.5	0.17
Sampler	4, 323	26.20	< 0.001	

Woodpigeon	***Degrees of freedom***	***F***	***P***	**beta**
Feather	4, 149	22.13	< 0.001	
Age	1, 149	2.73	= 0.10	
Feather x age	4, 149	11.53	< 0.001	
Wing size (NF)	1, 149	10.69	< 0.01	0.48

Turtle Dove	***Degrees of freedom***	***F***	***P***	**beta**
Feather	7, 1727	2757.46	< 0.001	
Age	1, 1727	162.98	< 0.001	
Feather x age	7, 1727	15.34	< 0.001	
Wing size (forearm)	1, 1727	461.03	< 0.001	1.48

Magpie	***Degrees of freedom***	***F***	***P***	**beta**
Feather	8, 602	1676.97	< 0.001	
Age	1, 602	6.45	< 0.05	
Feather x age	8, 602	2.32	< 0.05	
Wing size (forearm)	1, 602	267.9	< 0.001	1.70

Robin	***Degrees of freedom***	***F***	***P***	**beta**
Feather	8, 413	1151.31	< 0.001	
Age	1, 413	6.84		
Feather x age	8, 413	2.52	< 0.05	
Wing size (forearm)	1, 413	49.79	< 0.001	1.31

Blackbird	***Degrees of freedom***	***F***	***P***	**beta**
Feather	8, 305	1927.57	< 0.001	
Age	1, 305	8.54	< 0.01	
Feather x age	8, 305	4.54	< 0.001	
Wing size (forearm)	1, 305	8.89	< 0.01	0.34

Song Thrush	***Degrees of freedom***	***F***	***P***	**beta**
Feather	8, 997	6111.73	< 0.001	
Age	1, 997	20.21	< 0.001	
Feather x age	8, 997	3.65	< 0.001	
Wing size (NF)	1, 997	5.93	< 0.5	0.13
State	1, 997	122.61	< 0.001	

TABLE B3

Statistical results of Tukey post-hoc analysis for the GLMs testing for primary length differences between age groups, including body size measure (forearm or NF) as a covariate. In Quail the interaction was not significant and therefore not included here.

[Resultados estadísticos de los análisis "post-hoc" de Tukey de los GLMs para testar las diferencias en la longitud de las primarias entre grupos de edad, incluyendo el tamaño corporal (antebrazo o NF) como covariable. En las codornices la interacción no fue significativa, por lo que no la incluimos en esta tabla.]

	Woodcock (Corrected for forearm)		**Woodpigeon** (Corrected for NF)		**Turtle Dove** (Corrected for forearm)		**Magpie** (Corrected for forearm)		**Robin** (Corrected for forearm)		**Blackbird** (Corrected for forearm)		**Song Thrush** (Corrected for NF)	
Feather	*Z. ratio*	*P*	*Z. ratio*	*P*	*Z. ratio*	*P*	*Z. ratio*	*P*	*Z. ratio*	*P*	*Z. ratio*	*P*	*Z. ratio*	*P*
P10	0.08	0.94	1.65	0.10	12.77	**<0.001**	-2.54	**<0.01**	-2.62	**<0.01**	-2.92	**<0.01**	-4.50	**<0.001**
P9	0.94	0.35	4.50	**<0.001**	14.72	**<0.001**	-1.76	0.08	-0.50	0.62	0.32	0.75	-0.6	0.55
P8	1.26	0.21	6.22	**<0.001**	18.22	**<0.001**	0.12	0.90	1.43	0.15	2.47	**<0.05**	1.2	0.23
P7	2.45	**<0.05**	8.88	**<0.001**	24.38	**<0.001**	0.73	0.46	1.65	0.10	3.26	**<0.01**	1.38	0.17
P6	3.13	**<0.01**	9.60	**<0.001**	22.02	**<0.001**	1.37	0.17	2.30	**<0.05**	3.71	**<0.001**	1.7	0.09
P5	3.78	**<0.001**			20.97	**<0.001**	1.37	0.17	1.61	0.11	3.31	**<0.001**	-0.08	0.94
P4	3.79	**<0.001**			18.27	**<0.001**	0.88	0.38	1.59	0.11	3.25	**<0.01**	0.32	0.74
P3	3.15	**<0.01**			15.98	**<0.001**	0.91	0.36	2.12	**<0.05**	2.50	**<0.05**	1.0	0.32
P2							2.02	**<0.05**	1.77	0.08	3.04	**<0.01**	1.39	0.16