APPENDIX S1. TABLES S1-S6 AND FIGURES S1-S2 WITH SUPPORTING DETAILS OF MATERIAL AND RESULTS

Contrasting strategies for wing-moult and pre-migratory fuelling in western and eastern populations of Common Whitethroat *Sylvia communis*

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Table S1. Mean relative mass of flight feathers in adult Common Whitethroats expressed as a % of the total mass of all wing feathers treated as 100%, and as % of the total mass of all primaries (P1–P9) treated as 100%. The relative mass was derived by averaging the mass of corresponding feathers from both wings in one bird found dead in Poland.

Primary no	P1	P2	P3	P4	P5	P6	P7	P8	P9
Mean mass relative to P1-T3 mass [%]	5.7	6.0	6.2	6.9	7.1	7.7	8.2	8.6	9.3
Mean mass relative to P1-P9 [%]	8.7	9.1	9.5	10.2	10.8	11.8	12.7	12.9	14.2
Secondary or tertial no	S1	S2	S3	S4	S5	S6	T1	T2	T3
Mean mass relative to P1-T3 mass [%]	5.1	4.6	4.3	4.1	3.8	3.6	4.1	3.1	1.6

Table S2. Moult sequence and moult parameters of separate wing feathers for adult Common Whitethroats caught in July–October 2013–2016 in Poland. Feathers numbered as in de Beer (2001). All moult parameters estimated using the Underhill-Zucchini moult model for data type 4 (pre-moult birds excluded). [#] (in the first column) = estimates obtained from combined data for P1–P4, and for T1–T3, using the feather number as a covariate and assuming common sd of moult start date. T1–P9 = moult timing calculated from the moult start of the first feather to the moult end of the last replaced feather (dates in bold). All = moult timing calculated for all wing feathers combined. Primaries = for all primaries combined. *n* = sample sizes. The rate of growth (% PFMG/day) calculated as the relative mass of the feather (or group of feathers) divided by moult duration of that feather (group of feathers). Asterisks = moult duration in Poland longer, and moult rate slower than for the corresponding feathers in South Africa (see Table S3), at statistical significance: * = $P < 0.05$,** = $P < 0.001$ (one-sided Z-test). n/a = not applicable.

Feather	Moult parameters				*n*			Rate of growth (%PFMG/ day)	Inter-shedding intervals (days)
	Mean start date (se)	Duration in days (se)	SD of start date (se)	Mean end date (se)	Pre-moult	In moult	Post-moult		
T1[#]	**30 Jun (10.1)**	33 (8.9)**	17.7 (6.9)	1 Aug (10.1)	17	30	93	0.12*	
P1[#]	1 Jul (10.1)	20 (7.7)**	10.4 (3.4)	22 Jul (10.1)	4	10	126	0.28**	1
S5	5 Jul (10.1)	45 (10.2)**	16.4 (7.6)	19 Aug (10.1)	50	50	40	0.08**	4
S1	8 Jul (10.1)	30 (7.3) **	14.6 (6.2)	7 Aug (10.1)	25	37	78	0.17*	3
S2	9 Jul (6.6)	35 (6.8) **	13.1 (5.3)	13 Aug (6.6)	40	46	54	0.13**	1
P2[#]	9 Jul (9.1)	16 (9.1) *	10.4 (3.4)	23 Jul (9.1)	5	14	121	0.38	0
P3[#]	9 Jul (9.4)	15 (9.4)	10.4 (3.4)	23 Jul (9.4)	10	11	119	0.41	0
T2[#]	11 Jul (10.6)	20 (9.4) **	17.7 (6.9)	30 Jul (10.6)	9	28	103	0.16**	2
P6	11 Jul (5.3)	26 (5.1) **	10.0 (3.8)	6 Aug (5.3)	16	33	91	0.29**	0
P9	11 Jul (4.9)	44 (5.9) **	11.8 (4.4)	**24 Aug (4.9)**	24	83	33	0.21**	0
P8	13 Jul (4.6)	36 (5.1) **	11.0 (4.0)	18 Aug (4.6)	24	65	51	0.24**	2
P4	13 Jul (6.8)	16 (5.9) **	9.0 (4.0)	29 Jul (6.8)	12	18	110	0.42	0
P7	13 Jul (5.0)	31 (5.1) **	11.1 (4.2)	13 Aug (5.0)	20	51	69	0.26**	0
P5	14 Jul (7.2)	18 (6.1) **	10.31 (4.5)	1 Aug (7.2)	15	22	103	0.40	1
S4	14 Jul (8.8)	37 (9.7) **	15.6 (7.5)	20 Aug (8.8)	66	43	31	0.11**	0
T3[#]	18 Jul (11.9)	13 (9.4) **	17.7 (6.9)	31 Jul (11.9)	14	22	104	0.13	4
S6	19 Jul (5.5)	32 (6.1) **	12.1 (5.0)	20 Aug (5.5)	42	57	41	0.11**	1
S3	23 Jul (5.7)	23 (5.9) **	11.1 (4.8)	15 Aug (5.7)	65	37	38	0.19*	4
T1–P9	**30 Jun (10.1)**	56 (n/a)	(n/a)	**24 Aug (4.9)**	9	98	33	1.78	
Primaries	**3 Jul (3.4)**	48 (3.9)	10.0 (3.1)	**20 Aug (3.4)**	0	104	33	2.08	
All	**2 Jul (3.7)**	55 (4.6)*	10.9 (3.5)	**26 Aug (3.7)**	3	122	15	1.82	

Table S3. Moult sequence and moult parameters of separate wing feathers for adult Common Whitethroats caught in November–April 1987-2017 in South Africa. Feathers numbered as in de Beer (2001). For all feathers moult timing estimated using the Underhill-Zucchini moult model for data type 2. [#] (in first column) = estimates obtained from combined data for T1–T3, using the feather number as a covariate and assuming common sd of moult start date. P1–S4 = moult timing calculated from the moult start of the first and the moult end of the last replaced feather (dates in bold); the remaining symbols as in Table S2. All = moult timing calculated for all wing feathers combined.

eather	Moult parameters				n			Rate of growth (%PFMG/ day)	Inter-shedding intervals (days)
	Mean start date (se)	Duration in days (Sse)	SD of start date (se)	Mean end date (se)	Pre-moult	In moult	Post-moult		
P1	**31 Dec (4.4)**	11 (3.5)	18.2 (7.7)	16 Jan (4.4)	15	9	98	5.68	
P2	2 Jan (4.2)	14 (3.7)	18.8 (7.7)	19 Jan (4.2)	17	12	93	6.01	2
P3	7 Jan (3.8)	15 (3.6)	17.5 (6.9)	22 Jan (3.8)	20	14	88	6.25	5
P4	10 Jan (3.4)	13 (3.3)	15.6 (6.1)	21 Jan (3.4)	23	13	86	6.89	3
T1[#]	13 Jan (6.3)	22 (6.4)	23.5 (8.3)	4 Feb (6.3)	11	9	35	4.34	3
P5	13 Jan (3.0)	14 (3.2)	14.9 (5.7)	31 Jan (3.0)	25	14	83	4.08	0
T2[#]	16 Jan (8.3)	7 (4.1)	23.5 (8.3)	23 Jan (8.3)	12	3	40	4.09	3
T3[#]	16 Jan (8.3)	7 (4.0)	23.5 (8.3)	24 Jan (8.3)	12	3	40	3.81	0
P6	21 Jan (2.8)	12 (2.9)	13.5 (5.3)	1 Feb (2.8)	31	13	78	7.06	5
S1	23 Jan (4.3)	19 (4.8)	13.4 (5.8)	11 Feb (4.3)	14	10	31	5.03	2
P7	24 Jan (3.2)	17 (3.4)	16.8 (6.1)	10 Feb (3.2)	36	18	68	3.07	1
P8	27 Jan (3.0)	18 (3.3)	16.2 (5.7)	15 Feb (3.0)	40	22	60	1.63	3
S2	29 Jan (3.8)	21 (4.6)	13.9 (5.9)	19 Feb (3.8)	16	12	27	8.24	2
P9	30 Jan (3.1)	24 (3.7)	17.8 (5.9)	24 Feb (3.1)	44	28	50	7.73	1
S6	7 Feb (4.4)	19 (4.8)	17.0 (7.3)	25 Feb (4.4)	21	10	24	3.60	8
S3	9 Feb (4.1)	17 (4.6)	16.8 (7.0)	26 Feb (4.1)	22	10	23	8.57	2
S4	12 Feb (4.7)	15 (4.8)	20.8 (9.2)	**27 Feb (4.7)**	23	9	23	4.63	3
S5	12 Feb (4.3)	12 (4.2)	18.0 (8.0)	24 Feb (4.3)	23	7	25	9.29	0
P1-S4	**31 Dec (4.4)**	58 (n/a)	(n/a)	**27 Feb (4.7)**	15	17	23	1.71	
Primaries	**29 Dec (3.6)**	54 (4.6)	17.2 (5.3)	**21 Feb (3.6)**	15	58	50	1.86	
All	**2 Jan (5.2)**	57 (6.5)	16.9 (6.4)	**28 Feb (5.2)**	7	27	21	1.77	

Table S4. Underhill-Zucchini moult models used to determine the effect of region where moult takes place (see Fig. 1) on moult parameters estimated for all primaries, secondaries and tertials jointly in adult Common Whitethroats caught in July–October 2013–2016 in Poland and in November–April 1987–2017 in South Africa. Models ranked by Akaike Information Criteria corrected for small sample (AICc), k is the number of parameters in a model, ΔAICc gives the difference in AICc from the best model, the Akaike weights (wAICc) assess the relative support that a given model has from the data, compared with the other models. 1 = parameter assumed constant for Poland and South Africa. Best fitted model in bold face. PFMG = Proportion of Feather Mass Grown, Day = day number from 1 June, region = region (Poland or South Africa) used as a covariate. Models are formulated as in Erni *et al*. (2013).

Model no according to AICc	Moult parameters in model: | moult duration | mean start date | SD of start date	k	AICc	ΔAICc	wAICc
1	**PFMG ~ Day | 1 | region | region**	**5**	**969.43**	**0.00**	**0.58256**
2	PFMG ~ Day | region | region | region	6	971.89	2.46	0.17058
3	PFMG ~ Day | 1 | region | 1	4	972.26	2.83	0.14176
4	PFMG ~ Day | region | region| 1	5	974.24	4.81	0.05255
5	PFMG ~ Day | region | region | 1	5	974.24	4.81	0.05255
6	PFMG ~ Day | region | 1 | region	5	1002.27	32.84	0.00000
7	PFMG ~ Day | 1 | 1 | 1	3	1114.48	145.05	0.00000
8	PFMG ~ Day | region | 1 | 1	4	1119.03	149.60	0.00000

Table S5. Mean wing lengths of Whitethroats caught in the four study regions (Fig 1), considering the moult status of measured wings. Comparisons within region = comparisons of wing length measured on pre-moult (worn) and post-moult (fresh) wings in Poland and South Africa, where both categories occur; *U* and *P* = results of U-tests. Comparisons between regions = comparisons of the wing length of pre- and post-moult wings (as marked in the rows) between the regions; the pre-moult wing lengths in Poland and South Africa were compared to those in Siberia (Kruskal-Wallis ANOVA: $H_{2,450}$ =6.66, *P* =0.0358); the post-moult wings to those in Nigeria (Kruskal-Wallis ANOVA: $H_{2,123}$=8.42, *P* = 0.0149); *Z* and *p* = results of post-hoc Tukey's test.

Country	Moult status of wing	Wing length (mm)				Comparisons within region of pre-moult/post-moult birds		Comparisons between regions			
		Mean (sd)	Min	Max	*n*	*U*	*P*	*Z*	*P*	*Z*	*p*
Poland	Pre-moult	73.2 (2.3)	68	77	18	380.00	0.0950	0.05	0.9999	2.03	0.1265
	Post-moult	74.2 (1.8)	70	79	57			0.54	0.9999	1.54	0.3704
South Africa	Pre-moult	73.2 (2.1)	67	77	33	756.00	0.1500			2.48	**0.0392**
	Post-moult	73.8 (2.3)	69	79	32					2.23	0.0776
Siberia	Pre-moult	71.6 (3.1)	62	77	72						
Nigeria	Post-moult	74.6 (2.0)	69	81	337						

Table S6. Comparison of primary moult rates estimated by Underhill-Zucchini models for Whitethroats in Poland and in South Africa (Tables S2, S3) with those for other insectivorous passerine migrants. We calculated the moult rates (%PFMG/day) by dividing moult duration estimated in each study by the mass of all primaries = 100%, to enable comparisons of relative primary moult rates between species of different size. Species arranged by the primary moult rate; our results in bold.

Species	Location	Primary moult rate	Moult start date (se)	Moult duration in days (se)	Source
Barn Swallow *Hirundo rustica*	South Africa	0.81	29 Nov (0.4)	123 (0.7)	Burman 2016
Blackcap *Sylvia atricapilla*	SW England	1.41	12 Jul (0.6)	71 (1.3)	Morrison *et al*. 2015
Willow Warbler *Phylloscopus trochilus*	SW England	1.46	12 Jun (0.6)	69 (0.9)	Morrison *et al*. 2015
Willow Warbler *Phylloscopus trochilus*	Guinea Bissau	1.47	4 Dec (-)	68 (-)	Underhill *et al.* 1992
European Stonechat *Saxicola rubicola*	NW Germany	1.48	19 Jul (1.7)	68 (4.5)	Flinks *et al*. 2008
Willow Warbler *Phylloscopus trochilus*	Ivory Coast	1.49	24 Dec (3)	67 (4)	Salewski *et al*. 2004
Common Whitethroat *Sylvia communis*	SW England	1.50	4 Jul (0.7)	67 (1.4)	Morrison *et al*. 2015
Melodious Warbler *Hippolais polyglotta*	Ivory Coast	1.54	13 Sep (17)	65 (17)	Salewski *et al*. 2004
Common Whitethroat *Sylvia communis*	**NE South Africa**	**1.86**	**29 Dec (3.6)**	**54 (4.6)**	**this study**
Willow Warbler *Phylloscopus trochilus*	Brabant, Belgium	1.89	12 Jun (2.2)	53 (3.7)	Underhill *et al.* 1992
Common Whitethroat *Sylvia communis*	**Poland**	**2.08**	**3 Jul (3.4)**	**48 (3.9)**	**this study**
Willow Warbler *Phylloscopus trochilus*	Lapland, Finland	2.38	13 Jul (0.6)	42 (1.7)	Underhill *et al*. 1992

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Fig. S1. Moult timing and sequence of each wing feather for western (Poland–Nigeria) and eastern (Siberia–South Africa) Whitethroats. P1–P9 = primaries, S1–S6 = secondaries, T1–T3 = tertials, arranged as in a left wing with the bird facing away (de Beer *et al*. 2001). Bars = mean periods of feather growth (Tables S2 & S3), grey lines = estimated *SD* of the mean start dates (left) and mean end dates (right). Asterisks = feather where moult duration was longer in Poland than in South Africa (one-sided *Z*-test: * = $P < 0.05$,** = $P < 0.001$; Tables S2 & S3).

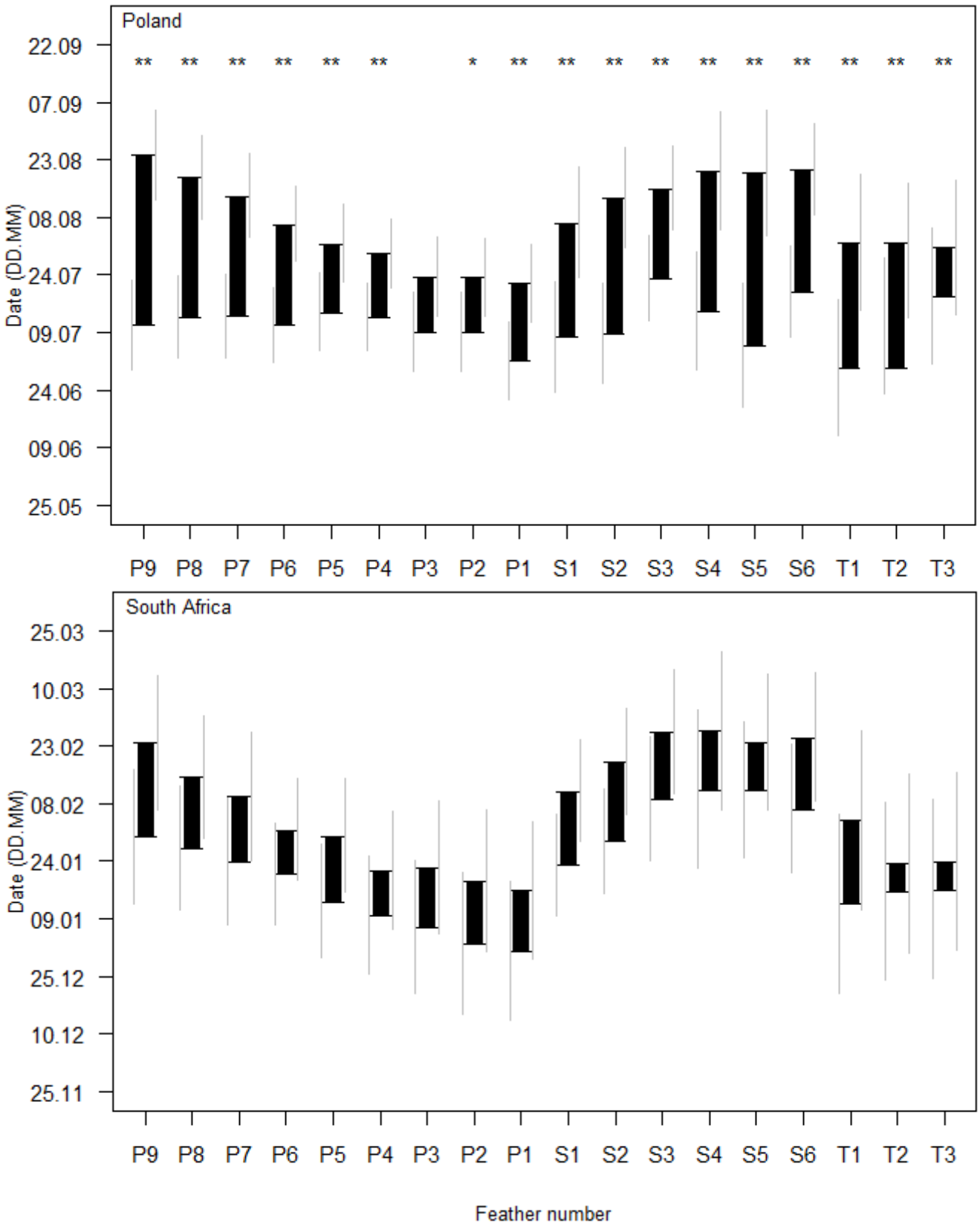

Fig. S2. The number of wing flight feathers growing simultaneously with the feather on the X-axis for Common Whitethroats in Poland and in South Africa. Squares = medians (white = Poland, black = South Africa), whiskers = range, black circles = values for the groups too small to calculate the medians, numbers above whiskers = sample sizes, asterisks = significant difference between Poland and South Africa (*U*-test: * = $P < 0.05$, ** = $P < 0.01$).