

Supplementary material

Table S1. Dates of data collection (mist netting) in the three study sites.

Year	Antikythira		Gavdos		Strofades	
	Start	End	Start	End	Start	End
2007	01-Apr	16-May				
2008	21-Mar	20-May				
2009	22-Mar	18-May			02-May	08-May
2010	20-Mar	19-May			02-May	07-May
2011	27-Mar	20-May	26-Apr	14-May		
2012	25-Mar	22-May	21-Apr	11-May	28-Apr	03-May
2013	24-Mar	22-May	10-Apr	15-May	26-Apr	29-Apr
2014	31-Mar	24-May			02-May	09-May
2015	01-Apr	23-May			04-May	07-May
2016	27-Mar	20-May				
2017	26-Mar	27-May				
2018	26-Mar	27-May			22-Apr	01-May
2019	26-Mar	24-May				

Table S2. Model parameter estimates of linear models (Equation 2 in the main text; $m_{0(\text{structural mass})} = b_0 + b_1 \times \text{wing length}$) for each study bird species and average and range of values for structural masses.

Species	b0 (± s.e.)	b1 (± s.e.)	r2	p	n	Aver (±sd)	Range
<i>Sylvia borin</i>	6.89 (±1.53)	0.08 (±4.43)	0.03	< 0.001	621	13.64 (±0.89)	10.3 - 15.9
<i>Sylvia communis</i>	2.56 (±5.06)	0.11 (±0.07)	0.08	0.12	32	10.76 (±0.72)	9.3 - 12
<i>Lanius senator</i>	-1.89 (±25.35)	0.27 (±0.25)	0.06	0.29	21	25.96 (±1.75)	21.3 - 28.7
<i>Acrocephalus arundinaceus</i>	-10.30 (±4.97)	0.33 (±0.05)	0.43	< 0.001	59	21.92 (±1.72)	18.6 - 25.2
<i>Acrocephalus schoenobaenus</i>	4.63 (±2.08)	0.06 (±0.03)	0.06	0.05	64	8.75 (±0.66)	6.3 - 10
<i>Ficedula hypoleuca</i>	5.57 (±1.82)	0.05 (±0.02)	0.02	0.03	204	9.55 (±0.62)	7.6 - 10.9
<i>Ficedula albicollis</i>	-3.12 (±2.61)	0.16 (±0.03)	0.23	< 0.001	84	9.78 (±0.68)	7.1 - 10.9
<i>Hippolais icterina</i>	0.98 (±2.55)	0.11 (±0.03)	0.24	0.001	40	9.85 (±0.42)	8.9 - 10.6
<i>Phylloscopus trochilus</i>	-4.89 (±1.40)	0.17 (±0.02)	0.69	< 0.001	31	6.45 (±0.6)	5.4 - 7.6
<i>Phylloscopus sibilatrix</i>	1.30 (±1.01)	0.08 (±0.01)	0.17	< 0.001	168	7.26 (±0.51)	5.5 - 8.3
<i>Luscinia megarhynchos</i>	-0.61 (±5.17)	0.19 (±0.06)	0.21	0.003	39	15.56 (±1.22)	11.3 - 17.1
<i>Phoenicurus phoenicurus</i>	-1.53 (±3.76)	0.16 (±0.05)	0.15	0.001	67	11.21 (±0.98)	9.7 - 13.3
<i>Oriolus oriolus</i>	4.60 (±10.72)	0.31 (±0.07)	0.11	< 0.001	200	51.43 (±3.6)	33.6 - 59.5
<i>Saxicola rubetra</i>	5.19 (±2.66)	0.09 (±0.03)	0.06	0.013	103	11.87 (±0.71)	10.2 - 13.3
<i>Muscicapa striata</i>	6.08 (±1.79)	0.06 (±0.02)	0.03	0.003	284	11.44 (±0.69)	8.8 - 13.6
<i>Delichon urbicum</i>	5.87 (±3.54)	0.06 (±0.03)	0.08	0.05	49	12.92 (±0.77)	11.2 - 14.4
<i>Riparia riparia</i>	7.73 (±1.24)	0.02 (±0.01)	0.02	0.07	183	9.99 (±0.53)	8.1 - 10.9
<i>Hirundo rustica</i>	6.57 (±4.95)	0.06 (±0.04)	0.04	0.14	52	13.91 (±0.91)	11.3 - 15.5

Table S3. Percent of individuals per species that needs to undertake obligatory stopover when reaches Greece after the Mediterranean crossing.

Species	Pooled		Strofades		Antikythira		Gavdos	
	%	s.e.	%	s.e.	%	s.e.	%	s.e.
<i>Oriolus oriolus</i>	26.5	16.75	45.5	7.61%	14.2	1.77	19.6	6.42
<i>Phylloscopus sibilatrix</i>	23.7	19.71	46.4	4.86	14.1	1.45	10.7	5.35
<i>Ficedula albicollis</i>	21.1	25.48	50.6	13.64	6.2	1.26	6.7	6.67
<i>Sylvia borin</i>	18.9	12.38	33.1	2.12	10.5	0.94	13.1	1.03
<i>Riparia riparia</i>	17.2	8.11	22.0	4.09	21.7	3.09	7.8	7.84
<i>Acrocephalus arundinaceus</i>	15.5	18.71	36.3	4.94	10.2	1.88	0	
<i>Muscicapa striata</i>	15.3	11.63	28.6	4.04	7.0	1.33	10.2	1.70
<i>Hirundo rustica</i>	14.2	9.26	24.2	5.59	12.5	2.06	5.9	4.12
<i>Phylloscopus trochilus</i>	14.1	12.10	27.8	6.68	9.9	1.26	4.8	4.76
<i>Phoenicurus phoenicurus</i>	13.0	11.56	25.7	4.19	10.4	1.66	3.0	3.03
<i>Saxicola rubetra</i>	12.8	10.22	23.8	4.30	11.0	1.56	3.6	1.81
<i>Delichon urbicum</i>	12.3	8.43	20.0	8.32	13.6	3.98	3.3	0.56
<i>Acrocephalus schoenobaenus</i>	11.7	1.61	11.3	3.85	10.2	1.33	13.4	8.81
<i>Ficedula hypoleuca</i>	11.3	11.92	24.5	5.14	8.0	0.67	1.3	1.33
<i>Hippolais icterina</i>	8.3	6.03	14.9	2.16	3.1	0.81	6.7	5.07
<i>Luscinia megarhynchos</i>	6.6	3.06	6.7	4.37	3.4	0.75	9.5	9.52
<i>Sylvia communis</i>	5.6	5.45	11.9	1.96	2.2	0.52	2.9	1.74
<i>Lanius senator</i>	3.3	4.07	7.9	2.91	2.2	0.52	0	

Table S4. Estimated number of birds migrating through Greece in spring and the overall number of birds from each species. Estimates of migrating birds were based on the national breeding population estimates of each species in each country that was included in the minimum convex polygon drawn around each species recoveries during spring migration (See Figure S1).

Species	Estimates of migrating birds			Estimates of birds undertaking obligatory stopover		
	Average	min	max	Average	min	max
<i>Acrocephalus arundinaceus</i>	3,827,300	2,826,500	4,828,100	592,585	437,630	747,540
<i>Acrocephalus schoenobaenus</i>	5,032,560	4,237,500	5,827,620	586,420	493,776	679,065
<i>Delichon urbicum</i>	12,047,100	7,907,200	16,187,000	1,484,179	974,152	1,994,207
<i>Ficedula albicollis</i>	3,379,745	2,620,670	4,138,820	714,752	554,222	875,281
<i>Ficedula hypoleuca</i>	5,397,260	4,724,720	6,069,800	608,158	532,377	683,940
<i>Hippolais icterina</i>	2,907,489	2,241,084	3,573,894	240,161	185,116	295,207
<i>Hirundo rustica</i>	21,022,900	14,516,200	27,529,600	2,990,142	2,064,677	3,915,607
<i>Lanius senator</i>	188,382	154,980	221,784	6,304	5,187	7,422
<i>Luscinia megarhynchos</i>	6,230,100	5,179,400	7,280,800	408,828	339,879	477,776
<i>Muscicapa striata</i>	10,434,400	7,376,600	13,492,200	1,592,478	1,125,803	2,059,154
<i>Oriolus oriolus</i>	4,663,700	3,686,400	5,641,000	1,233,785	975,240	1,492,330
<i>Phoenicurus phoenicurus</i>	3,395,650	2,314,140	4,477,160	442,301	301,429	583,174
<i>Phylloscopus sibilatrix</i>	12,959,720	9,581,920	16,337,520	1,832,555	1,354,921	2,310,189
<i>Phylloscopus trochilus</i>	55,505,535	41,706,340	69,304,730	13,173,038	9,898,097	16,447,978
<i>Riparia riparia</i>	3,160,460	2,354,480	3,966,440	543,741	405,076	682,405
<i>Saxicola rubetra</i>	4,031,760	3,332,240	4,731,280	516,170	426,614	605,727
<i>Sylvia borin</i>	9,788,450	7,091,900	12,485,000	1,847,425	1,338,491	2,356,359
<i>Sylvia communis</i>	20,933,000	18,011,400	23,854,600	1,181,944	1,016,981	1,346,906
TOTAL	184,905,511	139,863,674	229,947,348	29,994,967	22,429,666	37,560,269

Table S5. Species reaching Greece after crossing the Sahara Desert and the Mediterranean Sea during spring migration based on eBird records.

Species name	Species name
Great Reed Warbler <i>Acrocephalus arundinaceus</i>	Masked Shrike <i>Lanius nubicus</i>
Moustached Warbler <i>Acrocephalus melanopogon</i>	Woodchat Shrike <i>Lanius senator</i>
Marsh Warbler <i>Acrocephalus palustris</i>	Savi's Warbler <i>Locustella luscinioides</i>
Sedge Warbler <i>Acrocephalus schoenobaenus</i>	Thrush Nightingale <i>Luscinia luscinia</i>
Eurasian Reed Warbler <i>Acrocephalus scirpaceus</i>	Common Nightingale <i>Luscinia megarhynchos</i>
Tawny Pipit <i>Anthus campestris</i>	Bluethroat <i>Luscinia svecica</i>
Red-throated pipit <i>Anthus cervinus</i>	European Bee-eater <i>Merops apiaster</i>
Meadow pipit <i>Anthus pratensis</i>	Blue-cheeked bee-eater <i>Merops persicus</i>
Water pipit <i>Anthus spinoletta</i>	Western Yellow Wagtail <i>Motacilla flava</i>
Tree Pipit <i>Anthus trivialis</i>	Spotted Flycatcher <i>Muscicapa striata</i>
Common Swift <i>Apus apus</i>	Black-eared Wheatear <i>Oenanthe hispanica</i>
Alpine Swift <i>Apus melba</i>	Isabelline Wheatear <i>Oenanthe isabellina</i>
Pallid Swift <i>Apus pallidus</i>	Northern Wheatear <i>Oenanthe oenanthe</i>
Greater short-toed lark <i>Calandrella brachydactyla</i>	Eurasian Golden Oriole <i>Oriolus oriolus</i>
Eurasian Nightjar <i>Caprimulgus europaeus</i>	Common Redstart <i>Phoenicurus phoenicurus</i>
Red-rumped Swallow <i>Cecropis daurica</i>	Common Chiffchaff <i>Phylloscopus collybita*</i>
Great Spotted Cuckoo <i>Clamator glandarius</i>	Eastern Bonelli's Warbler <i>Phylloscopus orientalis</i>
European roller <i>Coracias garrulus</i>	Wood Warbler <i>Phylloscopus sibilatrix</i>
Common Cuckoo <i>Cuculus canorus</i>	Wood Warble <i>Phylloscopus sibilatrix</i>
Common House-Martin <i>Delichon urbicum</i>	Willow Warbler <i>Phylloscopus trochilus</i>
Cretzschmar's bunting <i>Emberiza caesia</i>	Bank Swallow <i>Riparia riparia</i>
Ortolan Bunting <i>Emberiza hortulana</i>	Whinchat <i>Saxicola rubetra</i>
Collared Flycatcher <i>Ficedula albicollis</i>	European Turtle-Dove <i>Streptopelia turtur</i>
European Pied Flycatcher <i>Ficedula hypoleuca</i>	Eurasian Blackcap <i>Sylvia atricapilla*</i>
Semicollared Flycatcher <i>Ficedula semitorquata</i>	Garden Warbler <i>Sylvia borin</i>
Icterine Warbler <i>Hippolais icterina</i>	Subalpine Warbler <i>Sylvia cantillans</i>
Olive-tree Warbler <i>Hippolais olivetorum</i>	Greater Whitethroat <i>Sylvia communis</i>
Barn Swallow <i>Hirundo rustica</i>	Eastern Orphean Warbler <i>Sylvia crassirostris</i>
Eastern Olivaceous Warbler <i>Iduna pallida</i>	Lesser Whitethroat <i>Sylvia curruca</i>
Eurasian Wryneck <i>Jynx torquilla</i>	Rüppell's warbler <i>Sylvia ruppeli</i>
Red-backed Shrike <i>Lanius collurio</i>	Eurasian Hoopoe <i>Upupa epops</i>
Lesser Gray Shrike <i>Lanius minor</i>	

* Species with populations wintering both north and south of the Sahara.

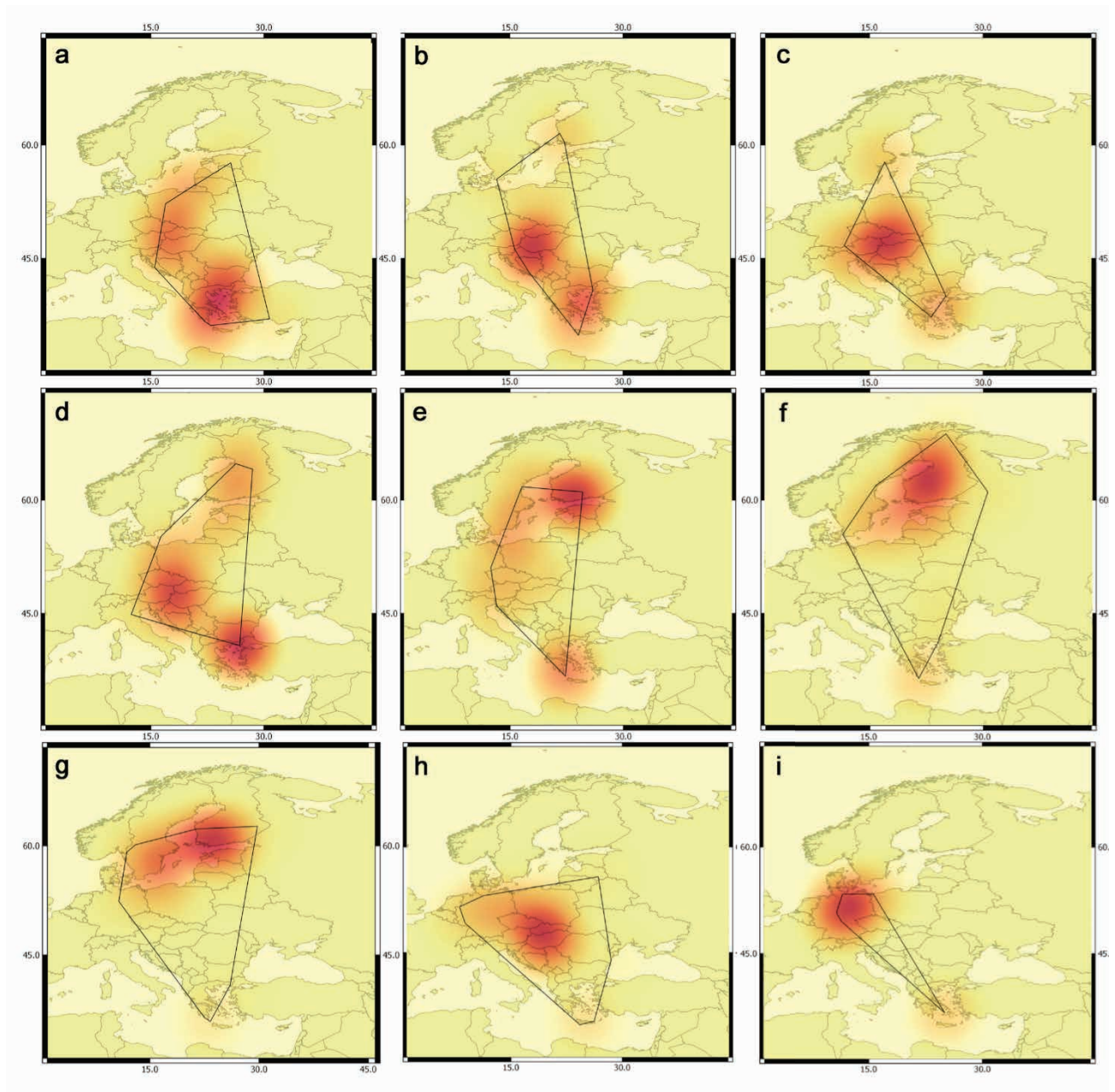


Figure S1. Minimum convex polygons containing ring sightings of birds ringed in Greece and recovered across Europe during spring migration and vice versa for: a) Acrocephalidae (*Acrocephalus arundinaceus* and *Hippolais icterina*), b) Hirundinidae (*Hirundo rustica*, *Delichon urbicum*, *Riparia riparia*), c) Muscipapidae (former Turdidae; *Saxicola rubetra*, *Phoenicurus phoenicurus*, *Luscinia megarhynchos*), d) *Acrocephalus schoenobaenus*, e) Sylviidae (*Sylvia borin*, *Sylvia communis*), f) Phylloscopidae (*Phylloscopus sibilatrix*, *Phylloscopus trochilus*), g) Muscipapidae (*Muscicapa striata*, *Ficedula hypoleuca*, *Ficedula albicollis*), h) *Oriolus oriolus*, i) *Lanius senator*. Heatmaps depict density of ring recoveries.