

Supplementary Materials

Table S1. Average number of annually ringed birds with standard deviation (SD), coefficients of variation, maximal number of locations and number of ringing years. Below the table are listed species that were ringed during autumn migration during the study period (2000–2016), but were due to low presence not included in modelling analyses.

Scientific name	Average no. of annually ringed birds \pm SD	Coefficient of variation among no. of ringed birds (%)	Coefficient of variation among no of ringed birds (%) after 3-yr. moving average	Coefficient of variation among no. of locations (%)	Max. no. of locations	No. of ringing years during 2000-2016
<i>Acrocephalus arundinaceus</i>	307.9 \pm 72.3	23.5	-	13.4	28	17
<i>Acrocephalus melanopogon</i>	23.4 \pm 20.3	86.6	-	43.2	13	17
<i>Acrocephalus palustris</i>	1258.4 \pm 430.6	34.2	-	22.2	45	17
<i>Acrocephalus schoenobaenus</i>	2827.6 \pm 910.1	32.2	17.1	17.5	45	17
<i>Acrocephalus scirpaceus</i>	3386.5 \pm 934.4	27.6	-	18.6	49	17
<i>Aegithalos caudatus</i>	270.17 \pm 96.6	35.8	21.5	24.8	45	17
<i>Anthus trivialis</i>	80.7 \pm 34.9	43.3	21.8	18.4	27	17
<i>Carduelis carduelis</i>	249.7 \pm 115.8	46.4	-	28.2	39	17
<i>Certhia brachydactyla</i>	10.1 \pm 5.7	56.5	-	50.8	12	17
<i>Certhia familiaris</i>	18.2 \pm 8.5	47.0	25.7	43.2	25	17
<i>Cettia cetti</i>	21.2 \pm 10.0	47.3	-	55.3	15	17
<i>Chloris chloris</i>	487.4 \pm 243.0	49.9	19.3	36.9	56	17
<i>Coccothraustes coccothraustes</i>	48.2 \pm 21.	45.4	-	60.0	37	17
<i>Curruca communis</i>	410.4 \pm 138.7	33.8	-	18.0	45	17
<i>Curruca curruca</i>	240.5 \pm 55.0	22.9	-	13.1	38	17
<i>Curruca nisoria</i>	20.4 \pm 8.4	41.4	-	31.1	13	17
<i>Cyanecula svecica</i>	38.3 \pm 14.6	38.1	-	39.3	23	17
<i>Cyanistes caeruleus</i>	980.8 \pm 385.9	39.3	24.4	19.3	77	17
<i>Delichon urbicum</i>	18.5 \pm 36.8	198.3	115.6	45.8	4	16
<i>Emberiza cia</i>	16.1 \pm 10.4	65.1	-	76.3	10	16
<i>Emberiza cirrus</i>	12.1 \pm 11.5	94.8	50.3	64.1	11	17
<i>Emberiza citrinella</i>	85.5 \pm 29.2	34.2	14.4	27.8	31	17
<i>Emberiza schoeniclus</i>	602.5 \pm 285.7	47.4	-	26.9	28	17
<i>Erithacus rubecula</i>	4103.5 \pm 1382.3	33.7	17.4	22.3	90	17
<i>Ficedula hypoleuca</i>	97.7 \pm 43.8	44.9	-	21.0	25	17
<i>Fringilla coelebs</i>	404.6 \pm 159.2	39.3	-	25.8	54	17
<i>Fringilla montifringilla</i>	96.8 \pm 87.7	90.6	34.1	59.4	28	16
<i>Garrulus glandarius</i>	11.4 \pm 5.8	50.8	27.5	41.0	14	17
<i>Hippolais icterina</i>	308.2 \pm 168.1	54.6	-	18.4	35	17
<i>Hippolais polyglotta</i>	7.4 \pm 3.9	53.4	-	40.8	5	17
<i>Hirundo rustica</i>	7634.1 \pm 5985.2	78.4	-	28.5	31	17
<i>Lanius collurio</i>	163.6 \pm 66.0	40.4	-	18.7	35	17
<i>Linaria cannabina</i>	33.2 \pm 22.1	66.5	-	68.2	25	17
<i>Locustella fluviatilis</i>	15.0 \pm 8.5	56.6	-	44.1	13	17
<i>Locustella luscinioides</i>	35.4 \pm 14.2	40.4	-	29.5	17	17
<i>Locustella naevia</i>	137.0 \pm 61.7	45.1	-	18.8	28	17
<i>Lophophanes cristatus</i>	50.2 \pm 23.6	47.0	29.8	39.3	37	17
<i>Loxia curvirostra</i>	9.7 \pm 11.6	119.8	65.0	91.6	9	14
<i>Luscinia luscinia</i>	23.0 \pm 8.3	36.3	-	35.1	18	17
<i>Luscinia megarhynchos</i>	153.8 \pm 34.4	22.4	-	18.0	32	17
<i>Motacilla alba</i>	15.7 \pm 19.4	124.0	-	35.7	7	17

<i>Motacilla cinerea</i>	6.1 ± 3.8	62.9	-	57.3	8	17
<i>Motacilla flava</i>	36.2 ± 39.0	107.7	-	56.4	9	17
<i>Muscicapa striata</i>	65.8 ± 24.5	37.3	-	18.8	20	17
<i>Oriolus oriolus</i>	6.2 ± 3.6	58.1	33.6	45.0	8	17
<i>Parus major</i>	1708.1 ± 897.5	52.5	17.3	21.8	94	17
<i>Passer domesticus</i>	205.4 ± 107.0	52.1	25.8	48.3	39	17
<i>Passer italiae</i>	9.8 ± 20.3	206.0	90.0	91.5	7	12
<i>Passer montanus</i>	998.4 ± 396.3	39.7	-	26.9	56	17
<i>Periparus ater</i>	854.0 ± 685.5	80.3	37.2	37.3	53	17
<i>Phoenicurus ochruros</i>	29.0 ± 14.6	50.5	25.9	40.8	26	17
<i>Phoenicurus phoenicurus</i>	49.4 ± 22.7	46.0	29.4	21.3	25	17
<i>Phylloscopus collybita</i>	1714.9 ± 366.3	21.4	-	18.2	61	17
<i>Phylloscopus sibilatrix</i>	440.8 ± 245.6	55.7	-	18.3	31	17
<i>Phylloscopus trochilus</i>	227.8 ± 98.3	43.2	20.1	15.3	39	17
<i>Poecile montanus</i>	37.7 ± 19.7	52.3	35.7	40.5	28	16
<i>Poecile palustris</i>	101.2 ± 52.3	51.7	15.3	30.1	43	17
<i>Prunella modularis</i>	4898.8 ± 1896.5	38.7	14.8	21.5	56	17
<i>Pyrrhula pyrrhula</i>	19.1 ± 16.2	84.9	25.3	57.0	15	15
<i>Regulus ignicapilla</i>	30.7 ± 11.1	36.4	-	43.6	32	17
<i>Regulus regulus</i>	1565.2 ± 1089.6	69.6	37.0	32.9	61	17
<i>Remiz pendulinus</i>	227.2 ± 190.5	83.8	46.7	44.3	20	17
<i>Riparia riparia</i>	83.3 ± 82.4	98.9	-	46.7	12	16
<i>Saxicola rubetra</i>	38.8 ± 11.1	28.7	-	26.8	18	17
<i>Saxicola rubicola</i>	34.4 ± 17.4	50.8	-	35.0	22	17
<i>Serinus serinus</i>	85.7 ± 40.7	47.6	-	41.0	35	17
<i>Sitta europaea</i>	23.4 ± 17.1	73.2	28.1	55.1	27	17
<i>Spinus spinus</i>	939.0 ± 1423.4	151.6	69.3	56.7	43	17
<i>Sturnus vulgaris</i>	133.4 ± 72.1	54.1	-	23.8	19	17
<i>Sylvia atricapilla</i>	18625.4 ± 5534.1	29.7	-	16.2	68	17
<i>Sylvia borin</i>	6481.6 ± 2132.7	32.9	-	15.3	52	17
<i>Troglodytes troglodytes</i>	95.6 ± 31.4	32.9	-	26.2	38	17
<i>Turdus merula</i>	575.8 ± 135.1	23.5	-	17.5	49	17
<i>Turdus philomelos</i>	257.1 ± 64.0	24.9	-	15.5	39	17

Rarely ringed passerine species: Paddyfield Warbler (*Acrocephalus agricola*), Blyth's Reed Warbler (*Acrocephalus dumetorum*), Eurasian Skylark (*Alauda arvensis*), Tawny Pipit (*Anthus campestris*), Meadow Pipit (*Anthus pratensis*), Water Pipit (*Anthus spinoletta*), Bohemian Waxwing (*Bombycilla garrulus*), Siberian Rubythroat (*Calliope calliope*), Citril Finch (*Carduelis citrinella*), Common Rosefinch (*Carpodacus erythrurus*), Red-rumped Swallow (*Cecropis daurica*), White-throated Dipper (*Cinclus cinclus*), Zitting Cisticola (*Cisticola juncidis*), Common Raven (*Corvus corax*), Carrion Crow (*Corvus cornix*), Subalpine Warbler (*Curruca cantillans*), Sardinian Warbler (*Curruca melanocephala*), Corn Bunting (*Emberiza calandra*), Ortolan Bunting (*Emberiza hortulana*), Pine Bunting (*Emberiza leucocephalos*), Black-headed Bunting (*Emberiza melanocephala*), Little Bunting (*Emberiza pusilla*), Rustic Bunting (*Emberiza rustica*), Collared Flycatcher (*Ficedula albicollis*), Red-breasted Flycatcher (*Ficedula parva*), Booted Warbler (*Hippolais caligata*), Olivaceous Warbler (*Iduna pallida*), Great Gray Shrike (*Lanius excubitor*), Lesser Grey Shrike (*Lanius minor*), Woodchat Shrike (*Lanius senator*), Parrot Crossbill (*Loxia pytyopsittacus*), Woodlark (*Lullula arborea*), Northern Nutcracker (*Nucifraga caryocatactes*), Northern Wheatear (*Oenanthe oenanthe*), Bearded Reedling (*Panurus biarmicus*), Spanish Sparrow (*Passer hispaniolensis*), Dusky Warbler (*Phylloscopus fuscatus*), Western Bonelli's Warbler (*Phylloscopus bonelli*), Yellow-browed Warbler (*Phylloscopus inornatus*), Eurasian Magpie (*Pica pica*), Snow Bunting (*Plectrophenax nivalis*), Eurasian Crag Martin (*Ptyonoprogne rupestris*), Yellow-billed Cough (*Pyrrhocorax graculus*), Orange-flanked Bush-robin (*Tarsiger cyanurus*), Redwing (*Turdus iliacus*), Fieldfare (*Turdus pilaris*), Ring Ouzel (*Turdus torquatus*), Mistle Thrush (*Turdus viscivorus*)

Table S2. All species for modelling and their ecological and life-history traits. See abbreviations for traits in Table 1.

Id	Species	Species abbreviation	Habitat	Diet	Migratory status in Europe	Migration distance	Breeding status in Slovenia	Breeding distribution range in Europe	Productivity [average no. eggs per pair per year]
1	<i>Acrocephalus arundinaceus</i>	ACRARU	WET	INVER	PAS	LM	RB	CBE	6.8
2	<i>Acrocephalus melanopogon</i>	ACRMEL	WET	INVER	PAS	SM	OB	SBE	6.8
3	<i>Acrocephalus palustris</i>	ACRPAL	WET	INVER	PAS	LM	RB	CBE	6.8
4	<i>Acrocephalus schoenobaenus</i>	ACRSCH	WET	INVER	PAS	LM	RB	CBE	8.3
5	<i>Acrocephalus scirpaceus</i>	ACRSCI	WET	INVER	PAS	LM	RB	CBE	6
6	<i>Aegithalos caudatus</i>	AEGCAU	FOR	INVER	RES	NM	RB	CBE	15
7	<i>Anthus trivialis</i>	ANTTRI	CL	INVER	PAS	LM	RB	CBE	10
8	<i>Carduelis carduelis</i>	CARCAR	CL	SEEDS	RES	SM	RB	CBE	12.5
9	<i>Certhia brachydactyla</i>	CERBRA	FOR	INVER	RES	NM	RB	SBE	9
10	<i>Certhia familiaris</i>	CERFAM	FOR	INVER	RES	NM	RB	SBE	8.3
11	<i>Cettia cetti</i>	CETCET	WET	INVER	RES	NM	RB	SBE	4.5
12	<i>Chloris chloris</i>	CHLCHL	FOR	SEEDS	RES	SM	RB	CBE	12.5
13	<i>Coccothraustes coccothraustes</i>	COCCOC	FOR	SEEDS	NOM	SM	RB	CBE	6
14	<i>Curruca communis</i>	CURCOM	CL	INVER	PAS	LM	RB	CBE	4.5
15	<i>Curruca curruca</i>	CURCUR	CL	INVER	PAS	LM	RB	CBE	7.5
16	<i>Curruca nisoria</i>	CURNIS	CL	INVER	PAS	LM	RB	SBE	6.8
17	<i>Cyanecula svecica</i>	CYASVE	WET	INVER	PAS	LM	NB	SBE	8.3
18	<i>Cyanistes caeruleus</i>	CYACAE	FOR	INVER	NOM	SM	RB	CBE	15
19	<i>Delichon urbicum</i>	DELURB	CL	INVER	PAS	LM	RB	CBE	6
20	<i>Emberiza cia</i>	EMBCIA	CL	INVER	RES	SM	RB	SBE	10
21	<i>Emberiza cirius</i>	EMBCIR	CL	SEEDS	RES	SM	RB	SBE	8.8
22	<i>Emberiza citrinella</i>	EMBCIT	CL	SEEDS	RES	SM	RB	CBE	10
23	<i>Emberiza schoeniclus</i>	EMBSCH	WET	INVER	RES	SM	RB	CBE	9
24	<i>Erithacus rubecula</i>	ERIRUB	FOR	INVER	RES	SM	RB	CBE	13.8
25	<i>Ficedula hypoleuca</i>	FICHYP	FOR	INVER	PAS	LM	RB	SBE	9.8
26	<i>Fringilla coelebs</i>	FRICOE	FOR	INVER	RES	SM	RB	CBE	6.8
27	<i>Fringilla montifringilla</i>	FRIMON	FOR	INVER	NOM	SM	OB	SBE	9
28	<i>Garrulus glandarius</i>	GARGLA	FOR	INVER	NOM	SM	RB	CBE	9
29	<i>Hippolais icterina</i>	HIPICT	FOR	INVER	PAS	LM	OB	CBE	6.8
30	<i>Hippolais polyglotta</i>	HIPPOL	CL	INVER	PAS	LM	OB	SBE	6.8
31	<i>Hirundo rustica</i>	HIRRUS	CL	INVER	PAS	LM	RB	CBE	9
32	<i>Lanius collurio</i>	LANCOL	CL	INVER	PAS	LM	RB	CBE	5

33	<i>Linaria cannabina</i>	LINCAN	CL	SEEDS	RES	SM	RB	CBE	7.5
34	<i>Locustella fluviatilis</i>	LOCFLU	FOR	INVER	PAS	LM	RB	CBE	7.5
35	<i>Locustella luscinioides</i>	LOCLUS	WET	INVER	PAS	LM	RB	CBE	8
36	<i>Locustella naevia</i>	LOCNAE	CL	INVER	PAS	LM	RB	SBE	8.3
37	<i>Lophophanes cristatus</i>	LOPCRI	FOR	INVER	RES	NM	RB	CBE	12
38	<i>Loxia curvirostra</i>	LOXCUR	FOR	SEEDS	NOM	SM	RB	CBE	3.5
39	<i>Luscinia luscinia</i>	LUSLUS	CL	INVER	PAS	LM	NB	SBE	6.8
40	<i>Luscinia megarhynchos</i>	LUSMEG	CL	INVER	PAS	LM	RB	CBE	6.8
41	<i>Motacilla alba</i>	MOTALB	CL	INVER	RES	SM	RB	CBE	13.8
42	<i>Motacilla cinerea</i>	MOTCIN	FOR	INVER	RES	SM	RB	SBE	10
43	<i>Motacilla flava</i>	MOTFLA	CL	INVER	PAS	LM	RB	CBE	7.5
44	<i>Muscicapa striata</i>	MUSSTR	FOR	INVER	PAS	LM	RB	CBE	6.8
45	<i>Oriolus oriolus</i>	ORIORI	FOR	INVER	PAS	LM	RB	CBE	6
46	<i>Parus major</i>	PARMAJ	FOR	INVER	NOM	SM	RB	CBE	12.8
47	<i>Passer domesticus</i>	PASDOM	CL	SEEDS	RES	NM	RB	CBE	10.5
48	<i>Passer italiae</i>	PASITA	CL	SEEDS	RES	NM	RB	SBE	12.5
49	<i>Passer montanus</i>	PASMON	CL	SEEDS	RES	SM	RB	CBE	9
50	<i>Periparus ater</i>	PERATE	FOR	INVER	NOM	SM	RB	CBE	18
51	<i>Phoenicurus ochruros</i>	PHOOCH	CL	INVER	RES	SM	RB	CBE	10
52	<i>Phoenicurus phoenicurus</i>	PHOPHO	FOR	INVER	PAS	LM	RB	CBE	7.5
53	<i>Phylloscopus collybita</i>	PHYCOL	FOR	INVER	PAS	LM	RB	CBE	11
54	<i>Phylloscopus sibilatrix</i>	PHYSIB	FOR	INVER	PAS	LM	RB	CBE	9
55	<i>Phylloscopus trochilus</i>	PHYTRO	FOR	INVER	PAS	LM	RB	CBE	9
56	<i>Poecile montanus</i>	POEMON	FOR	INVER	RES	NM	RB	CBE	7
57	<i>Poecile palustris</i>	POEPAL	FOR	INVER	NOM	SM	RB	CBE	7.5
58	<i>Prunella modularis</i>	PRUMOD	FOR	INVER	RES	SM	RB	CBE	11.3
59	<i>Pyrrhula pyrrhula</i>	PYRPYR	FOR	SEEDS	NOM	SM	RB	CBE	12.5
60	<i>Regulus ignicapilla</i>	REGIGN	FOR	INVER	RES	SM	RB	CBE	14.3
61	<i>Regulus regulus</i>	REGREG	FOR	INVER	RES	SM	RB	CBE	20
62	<i>Remiz pendulinus</i>	REMPEN	WET	INVER	PAS	SM	RB	SBE	9
63	<i>Riparia riparia</i>	RIPRIP	WET	INVER	PAS	LM	RB	SBE	6.8
64	<i>Saxicola rubetra</i>	SAXRUB	CL	INVER	PAS	LM	RB	CBE	8.3
65	<i>Saxicola rubicola</i>	SAXRUBI	CL	INVER	RES	SM	RB	CBE	15
66	<i>Serinus serinus</i>	SERSER	CL	SEEDS	RES	SM	RB	CBE	8.8
67	<i>Sitta europaea</i>	SITEUR	FOR	INVER	RES	NM	RB	CBE	10.5
68	<i>Spinus spinus</i>	SPISPI	FOR	SEEDS	NOM	SM	RB	SBE	6
69	<i>Sturnus vulgaris</i>	STUVUL	CL	INVER	RES	SM	RB	CBE	7.5
70	<i>Sylvia atricapilla</i>	SYLATR	FOR	INVER	PAS	SM	RB	CBE	6.8

71	<i>Sylvia borin</i>	SYLBOR	CL	INVER	PAS	LM	RB	CBE	6.8
72	<i>Troglodytes troglodytes</i>	TROTRO	FOR	INVER	RES	SM	RB	CBE	12
73	<i>Turdus merula</i>	TURMER	FOR	INVER	RES	SM	RB	CBE	12
74	<i>Turdus philomelos</i>	TURPHI	FOR	INVER	RES	SM	RB	CBE	10

Table S3. Percentages of recoveries by countries in geographic group after spatial clustering.

States in an individual geographical cluster	Percentages of recoveries of individual country in geographic group (%)
NE	
Austria	9.6
Czech Republic	26.4
Hungary	32.0
Poland	22.4
Slovakia	9.6
NW	
Austria	2.7
Belgium	25.5
Czech Republic	3.4
Germany	37.6
Great Britain	0.7
Nederland	26.8
Poland	1.3
Switzerland	2.0
NN	
Denmark	11.9
Germany	9.5
Latvia	1.2
Lithuania	3.6
Norway	11.9
Poland	6.0
Russia	10.7
Sweden	45.2
NNE	
Belarus	3.7
Estonia	7.4
Finland	61.1
Latvia	7.4
Lithuania	3.7
Poland	3.7
Russia	9.3
Sweden	3.7

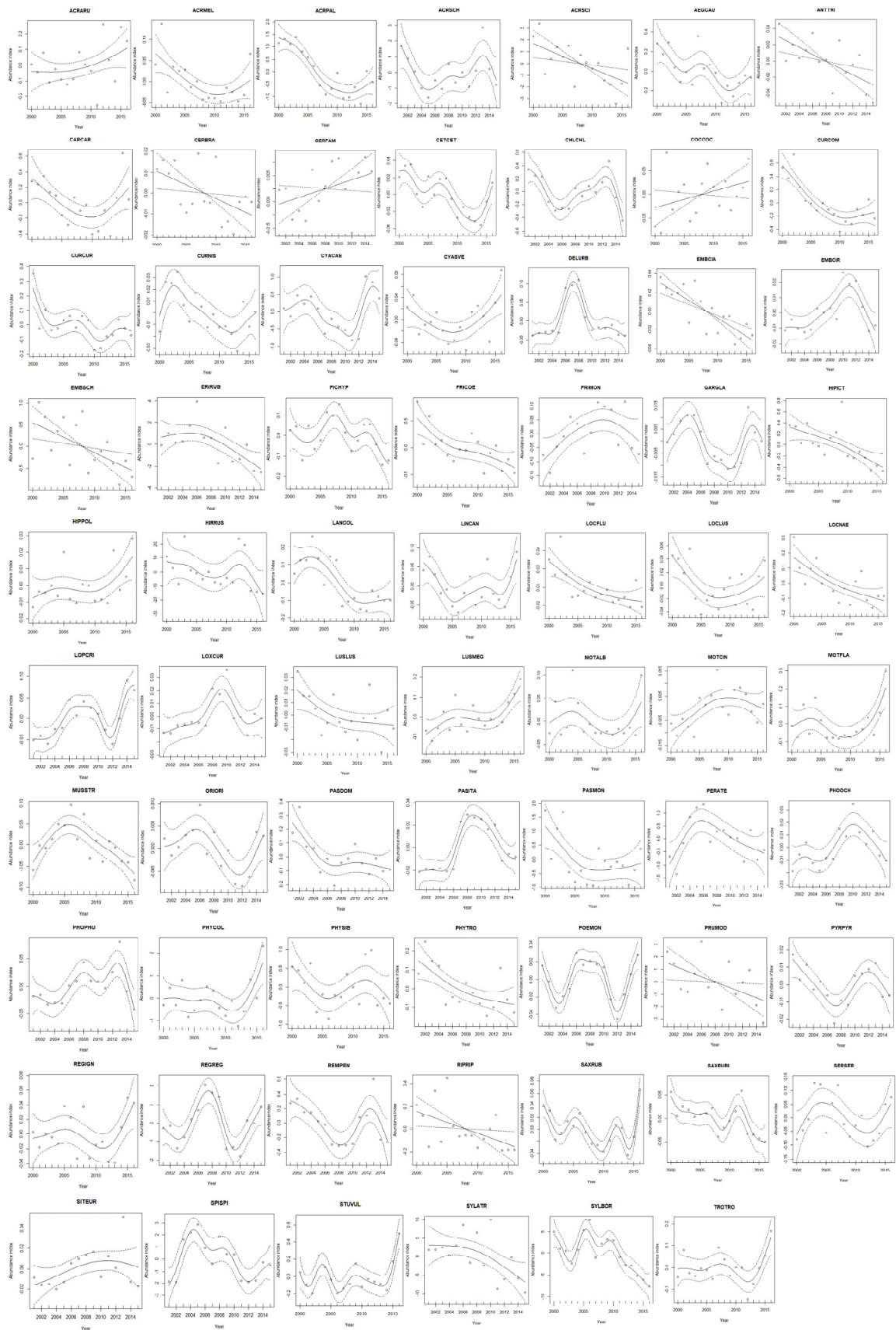


Figure S1. Models of population dynamics of studied passerine species on autumn migration in Slovenia according to long-term ringing data.

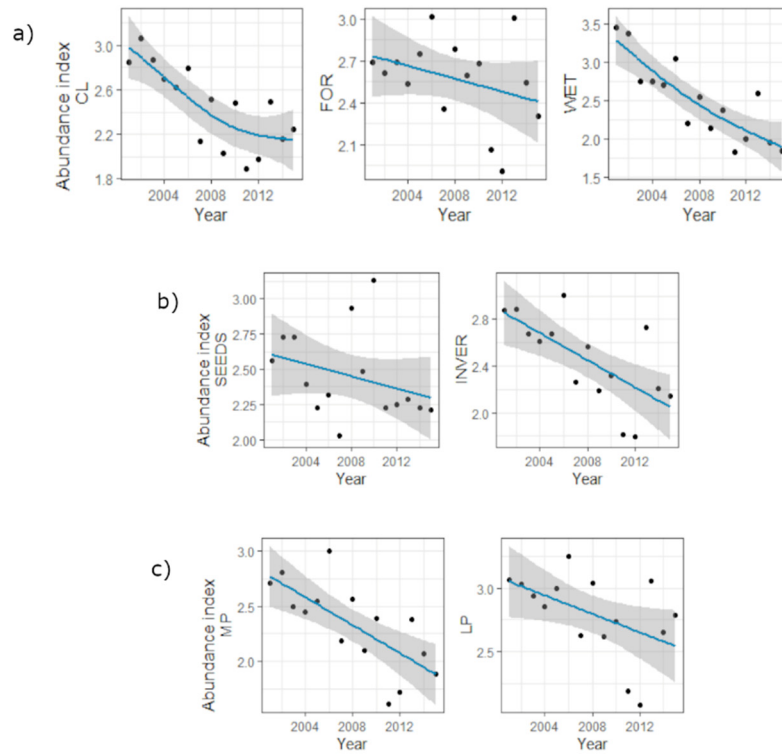


Figure S2. Modelling of population dynamics and trends for particular species guilds according to ecological traits: a) habitat traits, b) diet traits, and life-history traits: c) productivity for the period 2000–2016. See Table 1 for abbreviations.

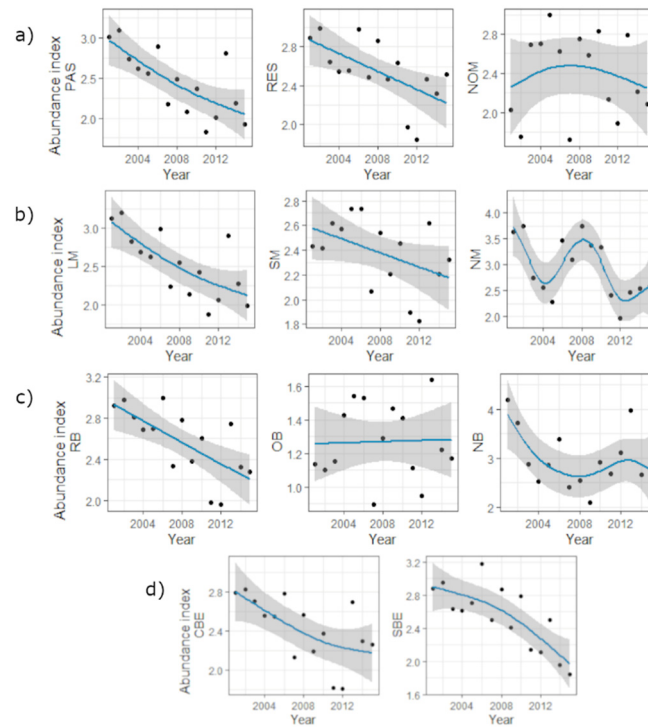


Figure S3. Modelling of population dynamics and trends for particular species guilds according to: a), b) migratory behaviour, and c), d) species occurrence in breeding season in Europe and Slovenia for the period 2000–2016. The model for OB (occasional breeders) is not significant with explained deviance < 10%. See Table 1 for abbreviations.

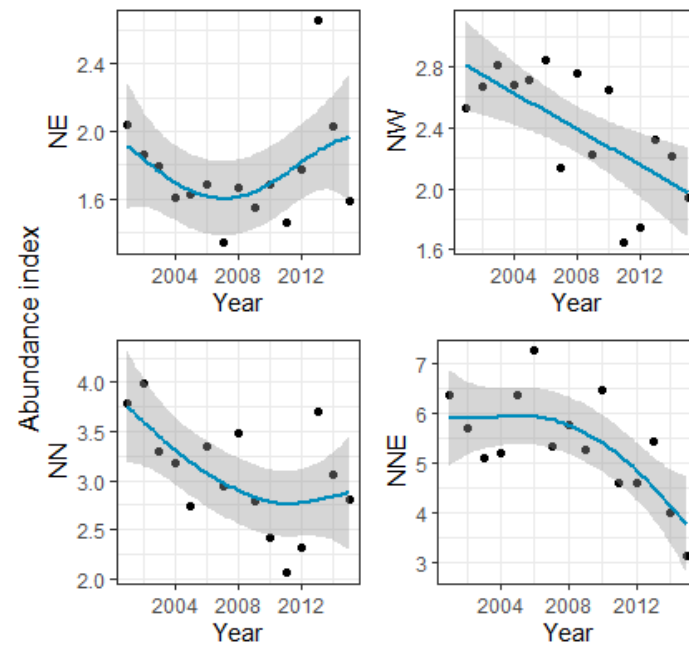


Figure S4. Modelling of population dynamics and trends for particular species guilds according to breeding origin (clusters of recoveries) for the period 2000–2016. See Table 1 for abbreviations.