

**Supplementary material**

## Supplementary material Appendix 1

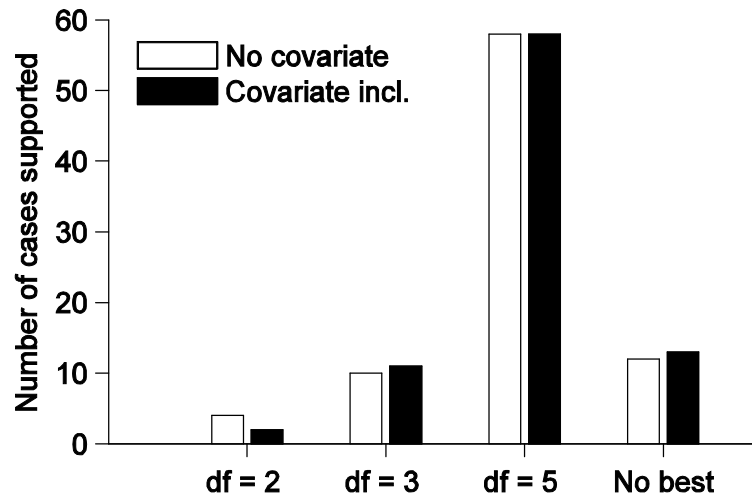
Table A1. Species considered in the analysis, how they are classified into categories and what type of data is used (“Standard” and “Total”, refers to the standardized morning migration count, and total migration count, respectively). For both seasons – spring and autumn – we report the start and end points of the investigated migration period as day of year. Only combinations of species and seasons with valid data from at least five years are considered (spring  $n = 28$ ; autumn  $n = 66$ ). Among the parametric models, convergence failed for some species in some years, indicated as “No” in column “Conv.” (problematic cases: spring  $n = 1$ ; autumn  $n = 9$ ). The remaining number of species analysed is 27 and 57, for spring and autumn, respectively.

Species	Category	Type of data	Spring			Autumn		
			Start	End	Conv.	Start	End	Conv.
<i>Anser anser</i>	Swans-geese	Standard	75	151	-	-	-	-
<i>Branta leucopsis</i>	Swans-geese	Standard	100	151	-	-	-	-
<i>Anas penelope</i>	Ducks	Standard	80	151	-	235	300	-
<i>Anas crecca</i>	Ducks	Standard	85	145	-	190	300	-
<i>Anas acuta</i>	Ducks	Standard	85	135	-	215	290	-
<i>Anas clypeata</i>	Ducks	Standard	100	151	No	-	-	-
<i>Aythya fuligula</i>	Ducks	Standard	-	-	-	240	325	-
<i>Somateria mollissima</i>	Ducks	Standard	-	-	-	245	300	-
<i>Bucephala clangula</i>	Ducks	Standard	-	-	-	245	340	-
<i>Gavia arctica</i>	Divers	Standard	95	165	-	190	300	-
<i>Podiceps cristatus</i>	Grebes	Stopover + Total	90	151	-	220	330	-
<i>Podiceps griseigena</i>	Grebes	Stopover + Total	90	160	-	-	-	-
<i>Pernis apivorus</i>	Raptors	Total	-	-	-	225	275	-
<i>Circus aeruginosus</i>	Raptors	Total	-	-	-	215	275	-
<i>Circus cyaneus</i>	Raptors	Total	-	-	-	230	310	-
<i>Accipiter gentilis</i>	Raptors	Total	-	-	-	235	315	-
<i>Accipiter nisus</i>	Raptors	Total	80	151	-	225	300	-
<i>Buteo buteo</i>	Raptors	Total	-	-	-	230	305	-
<i>Falco tinnunculus</i>	Raptors	Total	-	-	-	205	275	-
<i>Falco columbarius</i>	Raptors	Total	-	-	-	220	300	-
<i>Falco subbuteo</i>	Raptors	Total	-	-	-	215	275	-
<i>Haematopus ostralegus</i>	Waders, migration	Total	85	155	-	-	-	-
<i>Charadrius hiaticula</i>	Waders, migration	Total	-	-	-	195	270	-
<i>Pluvialis apricaria</i>	Waders, migration	Total	-	-	-	205	275	-
<i>Vanellus vanellus</i>	Waders, migration	Total	70	115	-	185	255	No
<i>Calidris canutus</i>	Waders, stopover	Stopover + Total	-	-	-	200	270	No
<i>Calidris alpina</i>	Waders, stopover	Stopover + Total	-	-	-	190	275	-
<i>Calidris pugnax</i>	Waders, stopover	Stopover + Total	-	-	-	182	275	-
<i>Gallinago gallinago</i>	Waders, stopover	Stopover + Total	-	-	-	200	340	No
<i>Numenius arquata</i>	Waders, migration	Total	-	-	-	182	250	-
<i>Tringa erythropus</i>	Waders, stopover	Stopover + Total	-	-	-	182	255	-
<i>Tringa nebularia</i>	Waders, migration	Total	-	-	-	182	250	No
<i>Tringa ochropus</i>	Waders, stopover	Stopover + Total	-	-	-	182	240	-
<i>Tringa glareola</i>	Waders, migration	Total	-	-	-	182	230	No
<i>Chroicocephalus ridibundus</i>	Gulls	Standard	80	120	-	-	-	-

<i>Laus fuscus</i>	Gulls	Standard	-	-	-	200	290	-
<i>Sterna hirundo</i>	Terns	Total	-	-	-	205	255	-
<i>Columba oenas</i>	Pigeons	Standard	-	-	-	240	305	No
<i>Columba plaumbus</i>	Pigeons	Standard	70	140	-	-	-	-
<i>Dryocopus martius</i>	Woodpecker	Total	-	-	-	230	310	-
<i>Dendrocopos minor</i>	Woodpecker	Total	-	-	-	225	310	-
<i>Lullula arborea</i>	Passerines, diurnal	Standard	-	-	-	250	305	-
<i>Alauda arvensis</i>	Passerines, diurnal	Standard	70	140	-	-	-	-
<i>Hirundo rustica</i>	Swallows	Standard	110	165	-	220	280	-
<i>Anthus trivialis</i>	Passerines, diurnal	Standard	105	155	-	220	260	-
<i>Anthus pratensis</i>	Passerines, diurnal	Standard	80	140	-	250	300	-
<i>Motacilla flava</i>	Passerines, diurnal	Standard	-	-	-	220	250	-
<i>Motacilla alba</i>	Passerines, diurnal	Standard	85	140	-	215	280	-
<i>Prunella modularis</i>	Passerines, diurnal	Standard	80	151	-	245	290	-
<i>Erithacus rubecula</i>	Insectivores	Ringling	-	-	-	235	300	-
<i>Turdus pilaris</i>	Thrushes	Standard	80	130	-	-	-	-
<i>Turdus viscivorus</i>	Thrushes	Standard	70	140	-	265	300	No
<i>Sylvia borin</i>	Insectivores	Ringling	-	-	-	215	275	-
<i>Phylloscopus trochilus</i>	Insectivores	Ringling	-	-	-	205	275	-
<i>Regulus regulus</i>	Insectivores	Ringling	-	-	-	250	305	-
<i>Aegithalos caudatus</i>	Tits	Standard	-	-	-	270	310	-
<i>Poecile montanus</i>	Tits	Standard	-	-	-	260	295	-
<i>Periparus ater</i>	Tits	Standard	-	-	-	250	305	-
<i>Cyanistes caeruleus</i>	Tits	Standard	75	125	-	260	315	-
<i>Parus major</i>	Tits	Standard	-	-	-	265	305	-
<i>Nucifraga caryocatactes</i>	Corvids	Standard	-	-	-	220	300	No
<i>Corvus monedula</i>	Corvids	Standard	-	-	-	270	300	-
<i>Corvus corone cornix</i>	Corvids	Standard	-	-	-	265	310	-
<i>Sturnus vulgaris</i>	Passerines, diurnal	Standard	-	-	-	265	310	-
<i>Passer montanus</i>	Passerines, diurnal	Standard	-	-	-	265	310	-
<i>Fringilla coelebs</i>	Passerines, diurnal	Standard	80	151	-	245	295	-
<i>Fringilla montifringilla</i>	Passerines, diurnal	Standard	80	140	-	255	300	-
<i>Carduelis chloris</i>	Passerines, diurnal	Standard	-	-	-	265	335	-
<i>Carduelis carduelis</i>	Passerines, diurnal	Standard	-	-	-	265	320	-
<i>Carduelis spinus</i>	Passerines, diurnal	Standard	-	-	-	240	315	-
<i>Carduelis cannabina</i>	Passerines, diurnal	Standard	80	140	-	265	315	-
<i>Loxia curvirostra</i>	Passerines, diurnal	Standard	-	-	-	185	320	No
<i>Pyrrhula pyrrhula</i>	Passerines, diurnal	Standard	-	-	-	275	335	-
<i>Emberiza citrinella</i>	Passerines, diurnal	Standard	70	140	-	260	335	-
<i>Emberiza schoeniclus</i>	Passerines, diurnal	Standard	80	140	-	255	305	-

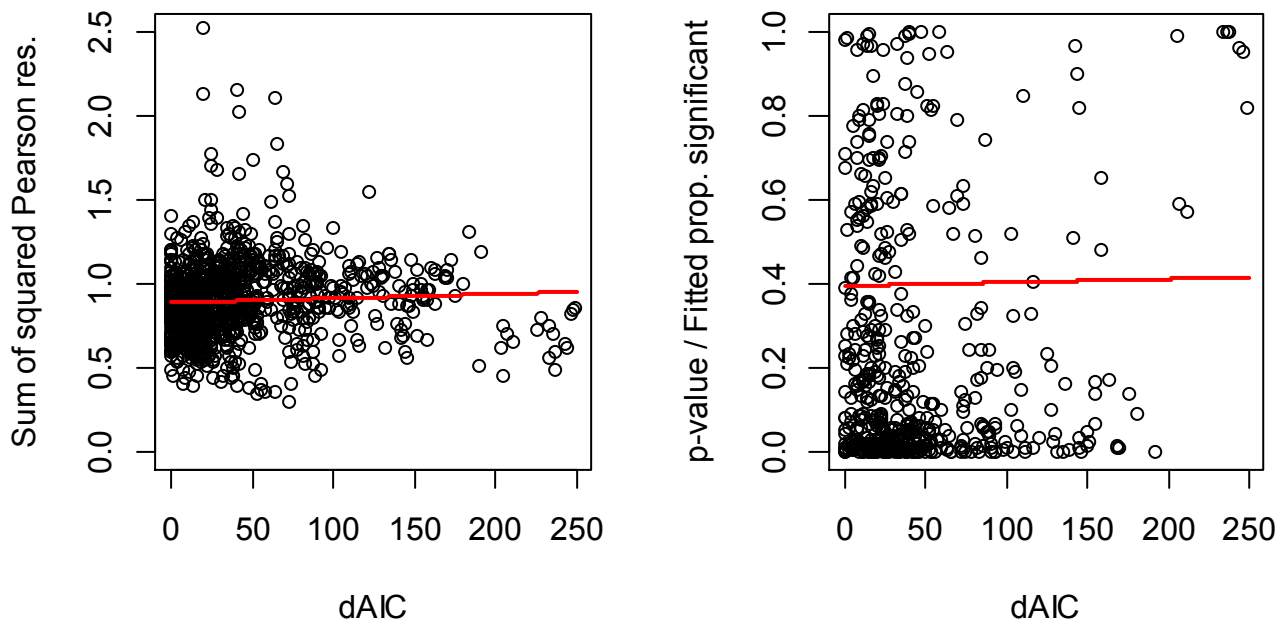
## Supplementary material Appendix 2

Figure A2. More complex models, including both GAMs and parametric models, were preferred over the more simple ones. This was the case both with and without covariates included in the model. A set of models is considered preferred when the evidence ratio (of summed Akaike weights) exceeds 5.



### Supplementary material Appendix 3

Figure A3. The left-hand panel illustrates goodness-of-fit in terms of average squared Pearson residuals (y-axis), against difference in AIC from best model (x-axis). A value of unity indicates good fit. The red line is a regression line. The right hand panel shows  $p$ -values from goodness-of-fit tests based on parametric bootstrap, and a fitted logistic regression line for the proportion of statistically significant values.



## Supplementary material Appendix 4

Figure A4. The left-hand panel illustrates goodness-of-fit in terms of Pearson residual autocorrelation (y-axis), against difference in AIC from best model (x-axis). A value of zero indicates good fit. The red line is a linear regression line. The right hand panel shows  $p$ -values from goodness-of-fit tests based on parametric bootstrap, and a fitted logistic regression line for the proportion of statistically significant values.

