$t = -3.13$, p = 0.002). There was no significant overall population × age interaction. We found no effect of age on spring intensity (corrected peak: effect = –0.80, 260.01 DF, $t = -0.67$, p = 0.5025; overall mean: effect = –0.25, 267.55 DF, $t = -0.26$, p = 0.7929), nor an effect of sex on intensity during either migration period in any population (Supplementary material Appendix 2, Fig. A3).

Age effects on nocturnal and diurnal activity

Migration periods
Across all populations, the intensity of diurnal activity during the migration periods showed declines after the first year. Paralleling the patterns in nocturnal activity, these declines occurred both in autumn (effect = –11.00, 344.66 DF, $t = -9.41$, p < 0.0001) and spring (effect = –5.88, 158.44 DF, $t = -3.26$, p = 0.0014). There were no significant interactions between population and age in these models.

Winter
Nocturnal activity during winter was subtly but significantly lower after the first year (effect = –0.97, 268.32 DF, $t = -3.5$, p = 0.0005); diurnal winter activity showed a stronger reduction (effect = –12.02, 348.59 DF, $t = -8.43$, p < 0.0001) (Supplementary material Appendix 2, Fig. A3).

Summer
The first summer for which we have sufficient data was the summer approximately one year after hatching. Comparing activity levels during this summer to those during subsequent years revealed no effects of age on nocturnal activity (effect = 0.5, 215.06 DF, $t = 1.58$, p = 0.1154), but a significant drop in diurnal activity (effect = –10.29, 106.89 DF, $t = -4.68$, p < 0.0001) (Supplementary material Appendix 2, Fig. A3).

Within-individual effects
We examined the consistency of *Zugunruhe* measurements in the same individual in different years, although we were constrained by the small number of same-bird measurements in our dataset (sample size from 20–67, depending on the measurement). Overall, subsequent *Zugunruhe* patterns were correlated within individuals, but these patterns were largely driven by population differences (Supplementary material Appendix 2, Fig. A4). After standardizing for population, individual consistency was much lower (Supplementary material Appendix 2, Fig. A5). Our data suggest that spring *Zugunruhe* intensities show the highest within-individual consistency of all our timing or intensity metrics (Supplementary material Appendix 2, Fig. A5 and A6).

Population-wide nocturnal activity during the migration periods

Comparison between populations
Using the complete dataset of all populations, we visually compared activity profiles of hybrids with those of their parental populations (Fig. 5C–F) and those of the three migratory populations (Fig. 7). Although birds without assigned *Zugunruhe* were included in this data set, all main patterns persisted, including distinctly elevated nocturnal

activity in Irish, relative to Austrian, birds. In some cases, reductions of activity over age were accentuated by inclusion of assigned non-migrants. In autumn, population-level nocturnal activity was most apparent in first-year birds (Fig. 7A) but decreased drastically in later years in Austrian and Irish individuals (Fig. 7C). In contrast, Siberian birds continued to show autumn nocturnal activity at levels on par with their first year. In spring, all migrant populations showed little appreciable change in nocturnal activity with age (Fig. 7B, D).

Quantitative comparisons of population-wide activity levels during the most active two-month periods of each population yielded results that were similar to those of peak intensity (Supplementary material Appendix 2, Fig. A6, top row). In particular, Irish partial migrants showed high mean and peak activities in spring that were not significantly different from those of Siberian long-distance migrants, and also significantly higher than those of Austrian short-distance migrants. In autumn, however, Irish stonechats showed mean and peak activities that were significantly lower than those of Siberian birds and similar to those of Austrian birds.

Nocturnal activity as proportion of night length
We detected generally minor differences in results when analysing *Zugunruhe* activity as a proportion of night length as opposed to in absolute units of time (Supplementary material Appendix 2, Fig. A6, bottom row). The exception was that Siberian stonechats, and to a lesser extent Austrian × Siberian stonechats, showed a higher relative peak activity level compared to the original analysis. This is because Siberian stonechats began *Zugunruhe* relatively late in spring and relatively early in autumn, when the nights were shorter than in the other populations. Some birds were active for nearly 100% of certain nights in spring.

Covariation of diurnal and nocturnal activity

Across all birds, we observed distinct differences in a bird's mean diurnal activity depending on whether it was also engaging in *Zugunruhe*. In the first 15 d of *Zugunruhe*, diurnal activity was significantly lower than in the 15 d preceding *Zugunruhe* onset in autumn (effect = –7.74, 844.04 DF, $t = -5.1$, p < 0.0001); in spring, however, this effect was much reduced, suggesting that birds compensated less for their nocturnal restlessness (interaction effect = 6.87, 848.2 DF, $t = 4.28$, p < 0.0001). A decrease in diurnal activity at the start of *Zugunruhe* was more pronounced for first year birds, regardless of the season (interaction effect = –3.51, 845.62 DF, $t = -2.19$, p = 0.0289). We found no significant interactions with population or sex. In the 15 d following *Zugunruhe* completion, diurnal activity in autumn increased relative to the preceding 15 d (effect = 3.13, 863.94 DF, $t = 2.7$, p = 0.007), and even more so in spring (interaction effect = 6.33, 862.58 DF, $t = 3.8$, p = 0.0002). There were no significant interactions with age, population, or sex.

Individual birds showed significant negative relationships between diurnal and nocturnal activity during periods of *Zugunruhe*: at the level of the individual day, birds were less active during days following high-activity nights (Supplementary material Appendix 2, Fig. A7; autumn: effect = –0.09, 202.5 DF, $t = -5.3$, p < 0.0001; spring: effect = –0.20,