Appendix 1 – Classification of Pre-migratory versus Migratory Movement

To distinguish pre-migratory from migration departure flights, we first analyzed the time of day of departure for juveniles undergoing their very first long-distance migratory flight. The location of the study area is on the north shore of Lake Erie so when a bird flew in a southerly direction overnight across the lake (~50 km) we assumed that this must represent the onset of fall migration. There were 25 tagged juveniles that were last detected by a tower within the study area and subsequently detected on the same night at a tower on the south side of Lake Erie along the lakeshore, and within a reasonable time frame (birds flying at ~50 km/hr.). We determined the average departure date and time of day of these 25 unambiguous first migratory flights. We used R package *circular* (Agostinelli and Lund 2018) to analyze if the time of migratory flight departure was non-random, as would be expected for true migratory flights which typically occur just after sunset. As expected, the time of day of these migratory movements was non-random (Rayleigh test, $\overline{R}= 0.713$, $p < 0.001$; Supplementary Material Fig. 1A) and on average within 2 hr. and 14 mins. of local civil sunset (sunset on average departure date was 08:42 p.m.). And as expected, the directional bearing for each first migration flight measured from the individual's last Motus tower detection within the study area to the next Motus tower on the south side of Lake Erie was southerly which was the case ($\overline{R}= 0.925$, $p < 0.001$; Supplementary Material Fig. 1B). Using the range of departure dates and times of day of departure for these 25 individuals, we subsequently assigned migration departure dates for an additional 57 individuals whose departure dates and times of day fell within the range of the unambiguous departures (mean departure date Sept. 19, range: Aug. 25 to Oct. 15; mean departure time 20:48, range: 18:26 to 22:47;). We could not confirm a southerly bearing of departure flights for these 57 individuals because they were not detected by Motus later the same night.

Motus towers cannot pinpoint the location of a bird (or the distance from the bird to the tower) and so smaller distance movements (e.g., ~ 1 km) near the natal site cannot be distinguished from birds that have not dispersed from the natal fragment. The detection range of Motus towers is low (~ 500 m) for radio-tagged songbirds within forest habitat (Crewe et al. 2019) but is far greater (~10 km or more) for birds that are flying in the open (Taylor et al. 2017). The estimated antennae range varies widely among towers due to differences in tower height, antennae type and orientation, and these are shown on the Motus Wildlife Tracking System interactive mapping (https://motus.org/data/receiversMap). There were Motus towers located < 5 km from the natal site, with antennae that were oriented away from the natal fragment but detected juveniles during the pre-migration period. These were included in this analysis because it was assumed that the tagged bird had to move out of the natal forest and into an area that was within range of that tower. There were 4 instances where this occurred, and the birds were added to the analysis and described as birds making > 5 km dispersal movements (i.e., included in $n = 93$).