**Appendix 1**

To generate distribution maps and climate data for summer-breeding monarchs, we downloaded monarch occurrence records from the Global Biodiversity Information Facility (GBIF) (dataset ID: doi.org/10.15468/dl.jx7wck). We then filtered these data to include only records from the United States and Canada during July and August, which coincides with the peak of the monarch’s summer breeding period. Summertime records of monarchs in locations known to support year-round breeding populations (e.g. South Florida, coastal Georgia and the Carolinas, areas along the Gulf Coast, and southern California) were excluded from analyses. The map in Figure 1A was created using the ggmap package (Kahle and Wickham 2013)

We separated monarchs into eastern versus western North America based on their location relative to the continental divide. This left us with 19,286 eastern and 1,266 western records from July and August. We then used the coordinates listed in the GBIF database to pull data on 30 year July-August temperatures (1988-2018) from the PRISM database (PRISM Climate Group) using the prism package v0.0.6 (Hart and Bell 2015), as well as Bioclim data from the WorldClim v2.1 database (Fick and Hijmans 2017) using the raster package v3.1-5 (Hijmans 2020). PRISM data was generated at 4 km resolution, while WorldClim data was generated at 2.5 minute resolution. Because PRISM only includes data from the continental United States, we also downloaded 1981-2010 climate normals for all Canadian provinces with monarch occurrence records (Environment and Climate Change Canada). Canadian monarch occurrences were matched to climate records for the nearest recording station using the distm function in the geosphere package v1.5-10 (Hijmans 2019). For summertime temperature records, we averaged July and August daytime high temperatures and used this value as our index of the thermal environment experienced by adult monarchs (see Figure 2A). For summertime precipitation, we used BIO18 (precipitation during the warmest quarter) for each monarch occurrence record and used this value as our index of summertime precipitation (see Figure 2B).

These metrics are not meant to be fully representative of conditions experienced by monarchs and are instead rough approximations of temperature and precipitation conditions in locations where adult monarchs have been recorded during July-August. Among the caveats in our analysis are that (1) adult monarchs are highly mobile, and so the location where they are observed may not accurately describe the conditions that they experience over their lifetime; (2) occurrence records were not spatially thinned, and so areas with higher human population density (and hence higher observation probabilities) are weighed disproportionately; (3) our climate metrics reflect seasonal or quarterly averages, rather than conditions experienced on the day of collection. Still, in spite of these caveats, we feel that the metrics used and shown in Figure 2 are broadly representative of summertime conditions experienced by eastern and western monarchs.

**References**

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