**ReadMe for “TPC and model analyses.R”**

This ReadMe gives a brief overview of how to use “TPC and model analyses.R”. ***Please note that running this script is not strictly necessary for the populations in the manuscript as all model predictions already exist in the “Model predictions” folder.***

**Input:** User-defined species name and location for an insect population or *all* = TRUE

**Output:** Updated CSV files in the “Model predictions” folder (if *save* = TRUE) for either a specified population (if *all* = FALSE) or all populations (if *all* = FALSE)

**To run:**

1. Update variable *species* (line 13) and *location* (line 14) with a species name and location from “Temperature response parameters.csv” or set *all* = TRUE to run the analyses for all populations
2. To save model predictions (over existing files in “Model predictions” folder), change *save* from FALSE to TRUE in line 18
3. Run the script

**Potential issues:**

* The script only works if the working directory (see line 10) is in the main folder of the downloaded GitHub repo
* The variable *species* (line 13) and *location* (line 14) must exist within “Temperature response parameters.csv” and match the “Population” and “Location” columns exactly

**Script details:**

Lines 5-18 Load required packages, set working directory and have user enter required information

Lines 21-30 Read in temperature response parameters and habitat temperature parameters and create data frame for results and for populations that go extinct in the population model

Lines 33-54 Get parameters for selected population, read in density-independent and density-dependent model time-series data, and define habitat temperature function (Eq. 5)

Lines 56-67 Determine if the population has gone extinct and remove any data after the extinction

Lines 69-103 Extract model time-series data for subsequent analyses, define start and end times for integrating TPCs and model predictions, and calculate total length of the active season (when habitat temperature is above the minimum developmental temperature, *Tmin*)

Lines 106-128 Directly integrate TPCs in the recent climate by first defining fitness metrics and fitness component TPCs, integrating over the TPCs, and dividing by the total active season (or total period for development time as development does not halt during overwintering)

Lines 131-153 Directly integrate TPCs in the future climate by first defining fitness metrics and fitness component TPCs, integrating over the TPCs, and dividing by the total active season (or total period for development time as development does not halt during overwintering)

Lines 156-201 Integrate model predictions in the recent climate by quantifying per capita birth rate, adult per capita mortality rate, and *R0* from model time-series data, summing across the daily values of fitness metrics and fitness components, and quantifying the average values over the total active season (or total period for development time as development does not halt during overwintering)

Lines 204-251 Integrate model predictions in the future climate by quantifying per capita birth rate, adult per capita mortality rate, and *R0* from model time-series data, summing across the daily values of fitness metrics and fitness components, and quantifying the average values over the total active season (or total period for development time as development does not halt while overwintering). Survival is set to zero for populations that go extinct

Lines 254-318 Record results, end for loop, and output results in CSV file (if save = TRUE)