Moth Wingspan Lengths Trend Upwards Alongside Elevation

**Introduciton**

The relationship between temperature and size ectotherms has been well documented throughout the past as being that lower temperature environments tend to lead to slower growth but larger fully-matured adult sizes (Kingsolver\* & Huey, 2008). This is commonly referred to as the temperature-size rule (TSR). Many other factors are incorporated into this as well, such as social behaviors and elevation (Guevara & Avilés, 2007). Elevation is one of the environmental aspects of the equation that is much less understood and there seems to be somewhat conflicting information on the subject. Some studies seem to suggest that size tends to have a negative correlation with elevation (Guevara & Avilés, 2007), while others have found evidence that there is a positive correlation (Brehm et al., 2019). As a result, this research was done with that premise in mind. This study aims to analyze the wingspan and elevation of various species of moths from Costa Rica and then look at the relationship between the two in an attempt to find correlations (if any). The hypothesis for this particular study is that moth wingspan will increase as the elevation increases.

**Methods**

Data for a large variety of moth genus and species was gathered (Brehm et al., 2019), which take place over a 2900m gradient of elevations in Costa Rica. The moth wingspans were originally measured in millimeters, and the elevation originally in meters. All analysis was done in R with standard packages and functions. The dataset was originally multiple datasets within a folder, but aspects of multiple spread sheets (primarily the genus and species of the moth specimens) were compiled together into a single sheet for easier access and analysis. Standard plotting methods were used to compare the elevation and wingspans of all moths. Statistical tests were all performed within R with built-in functions.

**Results**

The plot made using R found there was in fact a decent portion of correlation between the two parameters. The correlation coefficient between the elevation and moth wingspan was found to be 0.4309. The plot has many overlapping dots and dots of the same elevation as many were caught for sampling in large batches at a given site. There is a stair step-like pattern to the dots as they go up, but there is notably the most diversity in size of the wingspan size closer to the 1000m in elevation.



**Figure 1.**

Blue points represent moth specimens in the study. The red line indicates the trend following the average pattern between the elevation and wingspan values.

**Conclusion**

The data and analysis of said data seems to implicate that there is a low positive correlation between moth wingspan length and elevation. Elevations around 1000m seemed to give the most diverse set of wingspan lengths. This could potentially be due to some sort of ecological sweet spot that the moths are able to take advantage of in that given altitude. It isn’t clear that all ectotherms behave in this manner, but this bit of evidence helps us understand more about the elevation and size relationship of moths, and to a smaller extent ectotherms at large.

**Cited Literature**

Brehm, G., Zeuss, D., & Colwell, R. K. (2019). Moth body size increases with elevation along a complete tropical elevational gradient for two hyperdiverse clades. *Ecography*, *42*(4), 632–642. https://doi.org/10.1111/ecog.03917

Guevara, J., & Avilés, L. (2007). Multiple Techniques Confirm Elevational Differences in Insect Size That May Influence Spider Sociality. *Ecology*, *88*(8), 2015–2023. https://doi.org/10.1890/06-0995.1

Kingsolver\*, J. G., & Huey, R. B. (2008). Size, temperature, and fitness: Three rules. *Evolutionary Ecology Research*, *10*(2), 251–268.