Investigator’s Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Chill Coma Recovery in Lady Beetles**

Objective: Investigate the variation in chill coma recovery time in different populations of lady beetles.

Summary of Method:

* Expose members of a single population of lady beetles to 0℃ for 24 hours.
* Measure chill coma recovery time (as determined by a beetle’s ability to turn over onto its feet when placed on its back).
* Compare mean CCRT among different populations to look for statistically significant variation.

Research Hypothesis: If geographic location plays a role in lady beetles’ ability to recover from chill coma, and chill coma recovery time is measured in geographically distinct populations of lady beetles that have been exposed to 0℃ for 24 hours, then (*write your prediction here):*

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Statistical Analysis:

*Calculate your lab’s data and enter the values on the table below. Then calculate the Variance, Standard Deviation and Standard Error of the Mean for your lab’s data. Data for beetle populations from other locations are provided; calculate the variance and SEM for those populations as well.*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Time on ice** | **:**  **Mean Chill Coma Recovery Time (lab total)** |  | **n**  **(sample size)** | **Variance** | **Standard Error of the Mean** |
| Your lab’s data |  |  |  |  |  |
| Washington | 110.03 sec. | 3,706,036 | 115 |  |  |
| Arizona | 36.12 sec. | 39,556 | 130 |  |  |
| Northern CA | 44.76 sec. | 62,147 | 109 |  |  |
| Southern CA | 74.72 sec. | 368,432 | 39 |  |  |

Visualizing your Results: Graph the mean CCRT for each time interval; add Standard Error of the Mean bars. Follow all graphing expectations.

Response to Hypothesis:

*Recall that Standard Error of the Mean(SEM) bars say that if you repeated this experiment an infinite number of times, about two-thirds of the time (68.3%) the calculated mean would fall between the limits set by your SEM bars. About 95% of your sample means would be within two SEM for the entire population; almost all of your sample means would be within three standard errors. Thus, if there is overlap in your SEM bars from one sample to another, the difference between the samples is not statistically significant (in other words, the difference between samples is due to random variation in any given sample and is not a function of the variable you are testing). If there is NO overlap in your SEM bars from one sample to another, the differences between the samples may be statistically significant. You would need to do additional statistical tests to verify this.*

1. Based on your graph and the above information, are the differences between the recovery times in beetle populations from different geographic locations statistically significant? Explain briefly.
2. Write a response to the above Research Hypothesis in CER format (your claim will comment on whether the Research Hypothesis is supported or refuted; you will support your claim with evidence (both experimental and statistical); your reasoning will make meaning of your results and connect them back to what you know about climate change, lady beetles, and whiplash weather).
3. Next steps: Based on your findings, what new questions do you have? What tests could you do to answer those questions?