**CITIZEN SCIENCE PROJECT/EDDIEQUBES SP21**

**This activity explores the question: which species will be most affected by temperature changes, and how will changes in the phenology of one species affect its interaction with others as the climate warms?**

**Pre-Phenology Module Assignment**

**1- National Phenology Network**. Go to the National Phenology Website and read the page “[Why phenology](https://www.usanpn.org/about/why-phenology)?. Also, go to the [Volunteer Scientist](https://www.usanpn.org/partner/volunteer-scientists) page to understand more about the process by which phenology data are collected.

A. How would you define phenology?

B. Why do people care about phenology?

C. What is most interesting to you about phenology? (I hope something is!)

**2- Phenology Cues and Mismatches**.

A. Review this paragraph about plants **to identify some cues that affect phenology.**

“For example, we reviewed studies that sought to identify environmental cues for flowering or budburst and found that at the genetic and physiological levels, approximately half of all studies (51%, see Appen- dix S1) identify photoperiod or irradiance cues, with temperature following closely behind (32%). In con- trast, ecological (field or plot-scale) and climatological studies overwhelmingly find temperature cues across species and latitudes (86%) while <3% cite photoperiod or irradiance. All fields, however, find approximately the same proportion of cues due to precipitation, at about 10%. Resolving these differences is key to predicting biological responses to climate change because accurately forecasting phenology depends on identifying the correct cues. “ Pau et al. 2011. *Global Change Biology*

B. Now briefly explain or predict how the cues above or other factors affect the phenology of animal species as well. You may find it helpful to skim [this article](https://www.nytimes.com/2018/04/04/climate/animals-seasons-mismatch.html) about how climate change is affecting species interactions.

3- Based on what you have been discovered so far, try to sketch by hand 2 graphs of some predictions about phenology. To create these graphs, think about how we could measure the phenology of spring emergence for invertebrates (What y axis or IV? What X axis or DV?)

Graph 1: Graph 2:

B. How do you expect phenology to change across years as the climate warms? Why?

C. How do you expect phenology change with latitude? Why?

4- In class, we will practice regressions as an important tool to use when presenting data. Watch the introductory video posted below and answer the questions.

<https://www.youtube.com/watch?v=9AnIzAqAilc>

A. What does a regression tell you about?

B. What do you need to be careful about when conducting regression analyses? (correlation versus causation)

C. What does R2 tell you about?

**5- Read ONLY the Abstracts in the following two articles on Phenology and summarize their main findings in 2-3 lines (or bullet points)**

**Article 1:** Climate-associated phenological advances in bee pollinators and bee-pollinated plants

<https://www.pnas.org/content/pnas/early/2011/11/29/1115559108.full.pdf>

Main findings:

Question: Which Figure/s in this paper is/are showing trends and R2 values? How do you know?

**Article 2:** When spring ephemerals fail to meet pollinators: mechanism of phenological mismatch and its impact on plant reproduction

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6571468/pdf/rspb20190573.pdf>

Main findings:

Question: Which Figure/s in this paper is/are showing trends and R2 values? How do you know?