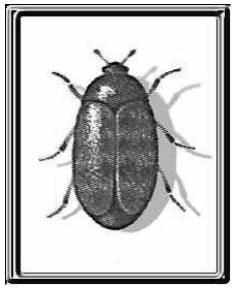
Name(s)_____ Date _____ Class Period ____

Investigation: *How do species change over time?*



Engage Print data table

1. Examine the photographs your instructor provides. What do these examples have in common (see power point)?

2. What is the purpose of the specific variations the photographs show?

3. The plants and animals that live in the hot, dry ecosystems in the Sonoran Desert are very different from those you see in Alaska, or in Costa Rica. Why might this be so?

Can this type of adaptation help explain how evolution works? Darwin thought so. In this investigation, you will be asked to think about data from the natural world as Darwin did, as you explore how adaptations relate to the concept of natural selection.

In this investigation, we will be working with models of the beetle species, *Beetlicus coloriferii*. This species of beetle has a wide range of color variations. Before the lab, professional beetle wranglers collected samples of 10 color variations, which you will be working with in the investigation. Your lab team will be working with a starting population of 20 of each color, and a fabric habitat.

4. Graph the starting population of beetles on the graph provided (see data table for colors). What graph type would be most appropriate?

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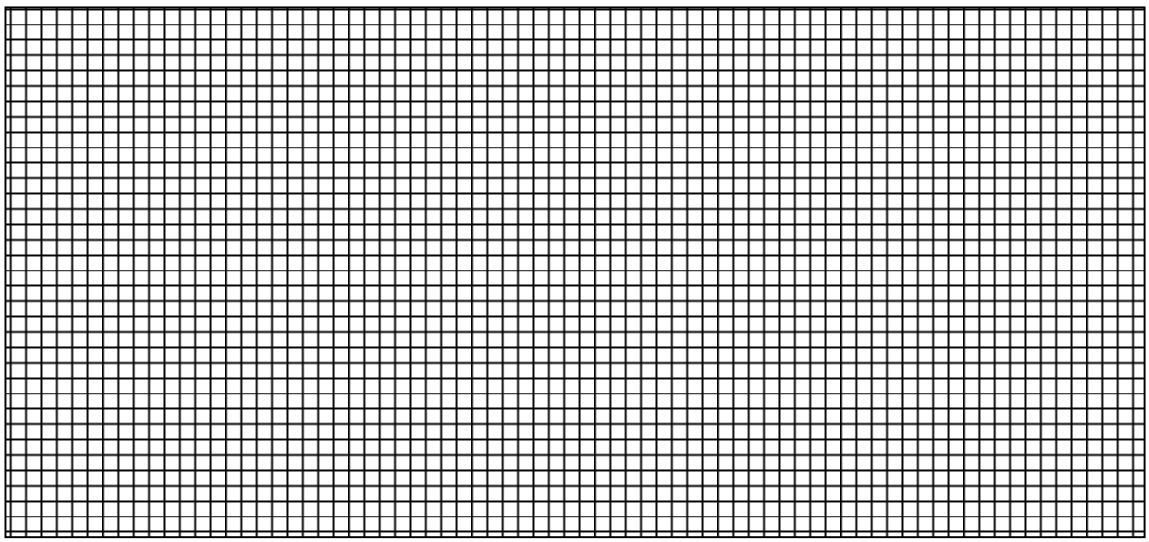


Explore

5. The beetle wranglers have supplied your Game Warden with 20 individual *Beetlicus coloriferii* from each color variation, for a total of 160 beetles. Check your supplies to be sure they are correct.

6. Examine the habitat you will be using, and describe it here:

7. What is the physical cause of color variation in the beetles (or, what makes one beetle's color differ from another's)?

8. Do you believe that the physical characteristics of this species will change over several generations of predation by the local predator, *Raptorus beetlicii*? That is, will the selection pressure of predation cause a change in this species on your habitat? Write your hypothesis here:

9. If your hypothesis is correct, what will happen to the beetles on your habitat? Write your prediction here:

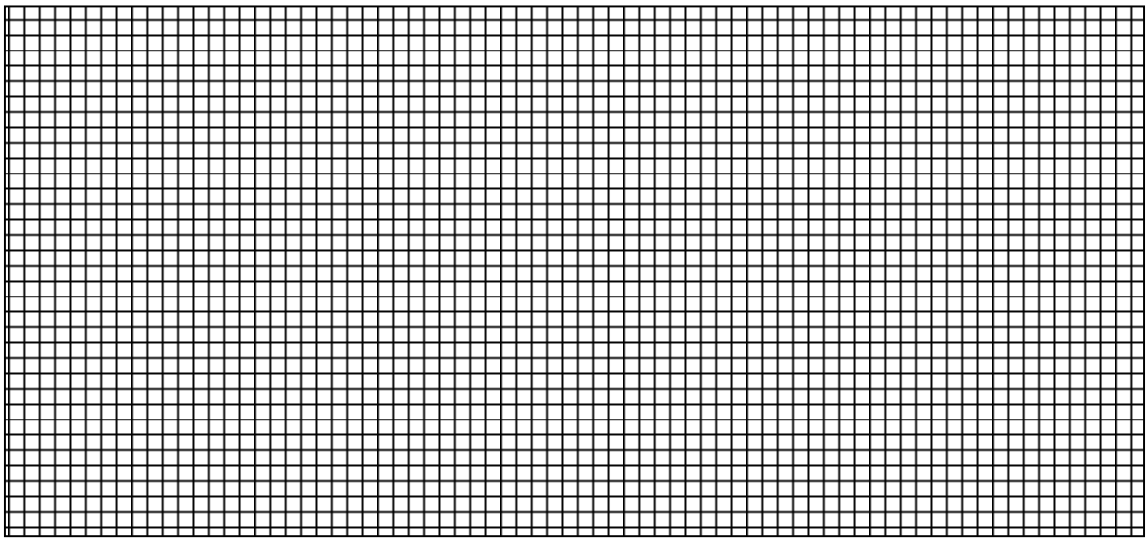
10. Now, visit another research team with a different beetle habitat. Describe their habitat, and write a second prediction for what will happen on **their** habitat, based upon your hypothesis:

11. Game Warden: distribute the beetles evenly (and randomly) over your habitat. Be sure the raptors do not break any rules during the simulation!

    Predators: You are modeling the behavior of the hawk-like bird, *Raptorus beetlicii*. This bird is active during low light conditions of early morning and evening (this is known as a _____ lifestyle). Your fingers will represent the bird, flying from the nest (petri dish lid) to the habitat to capture the plump, delicious beetles. *R. beetlicii* never consumes the food until after the hunt, so all beetles are deposited in the nest for later feasting. In addition, *R. beetlicii* never captures more than one beetle at a time, since they are squirmy and difficult to grasp securely during flight. This bird is ravenous, so work fast to capture as many beetles as possible!

12. When the predators' ideal light conditions (and, therefore, the hunt) are over, the Game Warden should carefully count and record the surviving beetles on the data table. Team members should assist with this task. Each survivor will reproduce, creating three new baby beetles. Return the survivors and their offspring to the habitat for the next round of predation, and be sure the data table accurately reflects the new starting population.

13. Repeat the simulation. Calculate the starting population for the third generation, then graph this final population on the supplied graph.



14. Compared to the starting population, what has happened?

15. Evaluate your hypothesis and prediction:

16. Revisit the neighboring habitat to view their results. Evaluate your second prediction:

17. If a change occurred in the beetle populations' characteristics, what caused it?

18. Did individual beetles change? What is your evidence?

19. How does this result relate to Lamarck's ideas about evolution, compared to Wallace and Darwin's ideas?

Explain

Draw your graph on the whiteboard at your lab group's number. Hang your habitat on the right side of the graph. Prepare for a class discussion of the results. After the class discussion, answer the following questions:

20. Are there patterns in the class results? What conclusions can be drawn from this data?

21. Identify any limiting factors present in this simulation.

22. How was the model realistic?

23. How was the model unrealistic?

24. Describe the relationship between the chance to survive and reproduce, and the traits an organism possesses.

25. What events in nature could cause an environment to change? List at least five.

26. What can happen to populations when their environment changes?

27. What would happen if the beetles where all the same color at the start?

28. If the color yellow were a warning color in nature (one that birds associate with being toxic and making them ill if they eat it), how would this affect the results on either habitat you examined?

29. In what way(s) would you expect the results to differ if a particular color of beetle was able to produce 6 offspring instead of 3?

Expand: Honors Biology Section

Investigate the effects of one of the following conditions on *Beetlicus coloriferii*:

A. Change in birth rate of beetles.
B. Climate change causes glaciation of the habitat.
C. Scoop up 20 random beetles from your original population, then trade habitats with a neighboring group to simulate the founder effect of a small sample colonizing a new, isolated habitat. Allow the 20 beetles to reproduce once before the predators attack!
D. Mutation: every third offspring is randomly selected from the available colors (or every third offspring is a different size).
E. DDT contamination affects the birds' reproductive success, and only one predator survives to feed on the beetles.

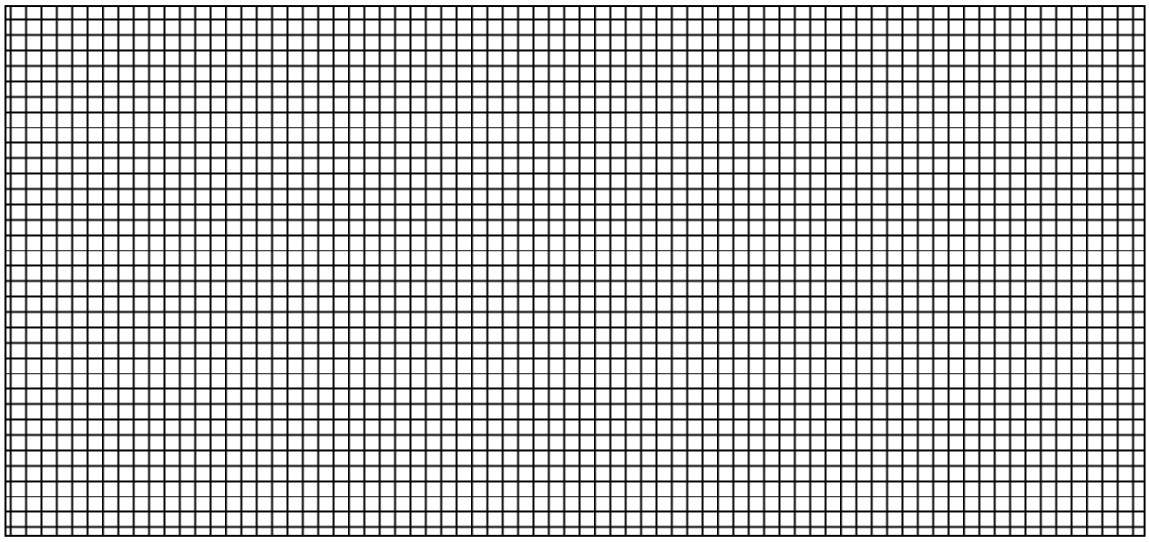
F. A different predator moves in after DDT wipes out the birds. This predator uses echolocation rather than vision to find its prey. Blindfold your predators and have them locate prey by touch to simulate this condition.

Complete the simulation model as before, starting with a hypothesis and prediction, graphing the initial and final populations, and drawing conclusions from the results.

Research Question:

Hypothesis & Prediction:

Results:



Conclusion: