# Purpose

In this assignment, you will apply concepts of statistics and probability to answer questions about how environmental factors affect the variation and distribution of expressed traits in a population.

Background Information

Genetic and environmental factors affect which traits are passed on from parent to offspring over generations and how they are passed on. Favorable traits for a given environment are passed on from parent to offspring. Unfavorable traits are selected against and inherited less frequently over time because they do not promote survival and reproduction.

Assignment Instructions

1. **Gather materials and necessary information.**
   1. Ask your teacher where you should save your assignment. You may also be able to print the document and complete it by hand before submitting it. Ask your teacher for guidance.
   2. If you have questions, ask your teacher for help.
2. **Complete the performance task.**
   1. **Respond carefully.** Follow the directions, and use your notes to help you complete the assignment.
   2. **Complete each part of the assignment.** Be sure to read each question carefully. If you have any trouble understanding the requirements, ask your teacher for assistance.
3. **Evaluate your assignment using this checklist. When you can answer “yes” to all of the questions, you are ready to submit your assignment.**

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| --- | --- | --- |
| **Yes** | **No** | **Evaluation Question** |
|  |  | Did you answer all of the questions for Part I, Part II, and Part III of the assignment? |
|  |  | Do your answers to the questions for each part include evidence from the data provided? |
|  |  | Are your answers written carefully and with correct spelling? |

1. **Revise and submit your assignment.**
   1. If you were unable to answer “yes” to all of the questions on the checklist, revise your work before submitting it.
   2. Return to the Virtual Classroom and use the “Add Files” option to locate and submit your assignment. Ask your teacher for assistance if necessary. Congratulations! You have successfully completed your assignment.
   3. Ask your teacher for further instructions about whether you will be presenting your findings to an audience of your peers.

# Assignment: Part I

**Use the graph and the information provided to answer the questions.**

Birds sing for a variety of reasons. Male birds sing to attract females. Both male and female birds sing when making nests, in preparation for the female laying eggs and for young birds to recognize their parents. In a particular species of bird, the females have evolved to be non-singing. This trait ensures that the nest is not detected by predators. The graph shows the inheritance of this trait through several generations.

1. What would be the percentage of the non-singing trait in female birds in Generations 4 and 5 if this pattern continues? (5 points)
2. In which generation will there be almost 100% non-singing females if there are no changes in the birds’ environment and interactions? (5 points)
3. In what possible scenario would the female birds evolve to having the singing trait? (5 points)

# Assignment: Part II

**Use the information provided to answer the question.**

The noniflower is a plant that grows in soil with a pH of 7.4 to 8. A variation of this species, called the mariflower, can grow at a more acidic pH. Researchers observed an area where noniflowers typically grow over a period of 50 years. Their data showed that the number of mariflowers slowly increased and the number of noniflowers slowly decreased. The impact of environmental factors on this trait shift was also documented.

|  |  |
| --- | --- |
| **Environmental Factor** | **Impact** |
| Increase in precipitation | High |
| Increase in number of factories in nearby areas | High |
| Change in temperature | Low |
| Change in length of days | Low |
| Introduction of invasive species | Low |

Explain why an increase in precipitation and in the number of nearby factories has a greater impact on the occurrence of the mariflowers than changes in temperature, length of day, and invasive species. (15 points)

# Assignment: Part III

**Use** **the graph and the information provided to answer the questions.**

Stickleback fish protect themselves from predators with a thick covering of brownish plates. They feed on small aquatic organisms and are preyed upon by bigger fish like trout. In a certain lake, the number of stickleback fish was documented over a period of 30 years. During this time, the clarity of the lake water also changed.

1. How did the occurrences of the different traits change over the 30-year period? Use evidence from the graph to support your answer. Using what you know about natural selection and adaptation, what generalization can you make based on these changes? (15 points)
2. What might be the correlation between the clarity of the lake water and the occurrence of the full body plate trait? What might you conclude about the clarity of the water from 1950 to 1980 based on this correlation? (10 points)
3. Both the full body plate type and the half body plate trait are also present in an ocean near the lake. Where would you expect a higher occurrence of the full body plate trait, in the lake or the ocean? Explain your answer. (5 points)
4. The clarity of lake water is affected by the amount of phytoplankton (marine plants), soil, clay, and other solids suspended in the lake. Suppose the concentration of carbon dioxide in the atmosphere changed from 340 ppm to 380 ppm from 1980 to 2005. What effect would this have on the occurrence of the full body plate trait? Explain your answer. Hint: Think about how carbon dioxide is related to photosynthesis. (10 points)