



Science Objectives

- Students will determine how humans can influence natural selection by manipulating the environment.
- Students will relate two sets of data, and analyze the patterns in long-term data.
- Students will develop an understanding of the effect of the environment on natural selection.

Vocabulary

- camouflage
- dependent variable
- environmental impact
- independent variable
- natural selection
- nocturnal

About the Lesson




- In this lesson, students examine some data about moths.
- As a result, students will:
 - Understand that the environment has an effect on natural selection.
 - Graph data and compare two sets of data.
 - Find patterns in long-term data and draw conclusions.



TI-Nspire™ Navigator™

- Send out the *Like_Moths_Around_a_Flame.tns* file.
- Monitor student progress using Class Capture.
- Use Live Presenter to spotlight student answers.

Activity Materials

- Compatible TI Technologies:  TI-Nspire™ CX Handhelds,  TI-Nspire™ Apps for iPad®,  TI-Nspire™ Software



Tech Tips:

- This activity includes screen captures taken from the TI-Nspire CX handheld. It is also appropriate for use with the TI-Nspire family of products including TI-Nspire software and TI-Nspire App. Slight variations to these directions may be required if using other technologies besides the handheld.
- Watch for additional Tech Tips throughout the activity for the specific technology you are using.
- Access free tutorials at <http://education.ti.com/calculators/pd/US/Online-Learning/Tutorials>

Lesson Files:

Student Activity

- Like_Moths_Around_a_Flame_Student.doc
- Like_Moths_Around_a_Flame_Student.pdf

TI-Nspire document

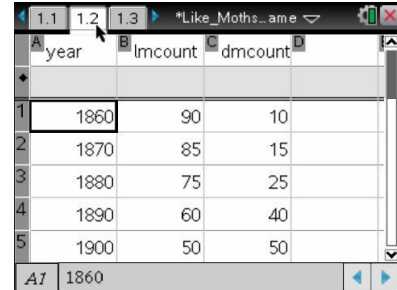
- Like_Moths_Around_a_Flame.tns



Discussion Points and Possible Answers

Move to page 1.2.

- Students examine the data in the spreadsheet, which shows a comparison of the number of moths of each color by decade. In 1860, for example, if 100 moths were counted, 90 of them would have been light, and 10 of them would have been dark. In this activity, students are told to assume that the counts for the sample accurately reflect the proportions in the entire population.



year	lmcount	dmcount
1860	90	10
1870	85	15
1880	75	25
1890	60	40
1900	50	50

Teaching Tip: In this activity, there are two sets of data that have the same independent variable. Make sure students realize that both dependent variables share the same independent variable.

Move to pages 1.3 and 1.4

Have students answer questions on either the device, on the activity sheet, or both.

- Which of the following is an independent variable in this activity?
(More than one response may be correct.)

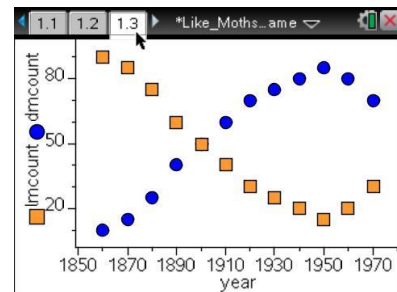
Answer: C. the year



- Which of the following is a dependent variable in this activity?
(More than one response may be correct.)

Answer: A. the number of dark-colored moths and B. the number of light-colored moths

Move to page 1.5.

- Students construct a graph by choosing variables for each axis. To add a second y-axis variable, they will select **Menu > Plot Properties > Add Y Variable**. Their graphs should look like the graph at the right. Students then look for trends in the data.



Tech Tip: To add a second variable to the y-axis, students should select  **> Plot Properties > Add Y Variable**. Students may need to back-out to the main Tools Menu  to see the desired menu option.



Move to page 1.6.

Have students answer question 3 in the .tns file, on the activity sheet, or both, and questions 4–11 on the activity sheet.

- Q3. Describe the trend(s) you see in the numbers of light-colored moths as the decades passed. Also describe the trend(s) you see in the numbers of dark-colored moths.

Answer: The light-colored moth population decreases until 1950, and then starts to increase. The dark-colored moth population increases until 1950, and then starts to decrease.

- Q4. From 1950 to 1970, what was the change in the number of light-colored moths? During this time, what was the change in the number of light-colored moths per year? per decade?

Answer: The count of light-colored moths increased by 15. This was an increase of .75 light-colored moths per year and an increase of 7.5 light-colored moths per decade.

- Q5. From 1950 to 1970, what was the change in the number of dark-colored moths? During this time, what was the change in the number of dark-colored moths per year? per decade?

Answer: The count of dark-colored moths decreased by 15. This was a decrease of .75 dark-colored moths per year, and a decrease of 7.5 dark-colored moths per decade.

- Q6. Using your answers for questions 4 and 5, predict when (after 1970) you would expect the number of each type of moth to be the same. Explain your prediction.

Answer: I expect the counts of each type of moth to be equal in the 1990s. Explanations will vary.

- Q7. During the middle 1800s, England began what was called the Industrial Revolution. Industry increased rapidly, and with that increase, came a much greater need for energy. Since nuclear power plants were still decades away, what source of energy did England use to power their huge increase in industry? What was the environmental impact of using this type of fuel? How do you think this impact influenced the numbers of light- and dark-colored moths?

Answer: The source of energy that England used to power their huge increase in industry was coal. The environmental impact of using this type of fuel was that there was more soot in the air, falling onto the trees and discoloring the light-colored bark. The impact on moths: Dark-colored moths would increase, and light-colored moths would decrease.



- Q8. During the middle 1900s, environmentalists really started voicing their concerns about the harmful effects that industry was having on the environment. England and other countries started paying closer attention to cleaning up the environment by reducing emissions from industrial factories. These concerns helped to promote policies like the Clean Air Act in many countries. As these policies became implemented, new forms of energy started being used, and industry was required to reduce emissions from their existing factories. What was the environmental impact of the Clean Air Act? How do you think this impact influenced the numbers of light- and dark-colored moths?

Answer: The environmental impact of the Clean Air Act was that there was less soot in the air, so less fallout onto the trees. The impact on moths: Light-colored moths would increase, and dark-colored moths would decrease.

- Q9. Explain how your answers to questions 7 and 8 could be used to explain the effects of natural selection on the population of peppered moths in England.

Answer: Depending on the color of the tree bark, either the light- or dark-colored moths would be selected *for* or selected *against*. Those selected *for* would be more likely to reproduce, while those selected *against* would not.

- Q10. What do you think would happen to the environment and to the moth population if factories went back to using older energy sources for their power, and the Clean Air Acts were eliminated? Explain your response. (Point students back to the answer from question 7 if they need help identifying “older energy sources”.)

Answer: It is likely that the population of the dark-colored moths would increase because of the darker colored bark. Dark moths would be selected *for*.

- Q11. Brainstorm and then describe another example of natural selection in animals, and one in plants

Answer: Answers will vary.



TI-Nspire Navigator Opportunities

Use TI-Nspire Navigator to capture screen shots of student progress and to retrieve the file from each student at the end of the class period. The student questions can be electronically graded and added to the student portfolio.



Wrap Up

When students are finished with the activity, pull back the .tns file using TI-Nspire Navigator. Save grades to Portfolio. Discuss activity questions using Slide Show. Make sure the concept of balancing torques is firm in their understanding and not balancing forces.

Assessment

- Formative assessment will consist of questions embedded in the .tns file. The questions will be graded when the .tns file is retrieved. The Slide Show will be utilized to give students immediate feedback on their assessment.
- Summative assessment will consist of questions/problems on the chapter test.