

Details

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- ✍️ High School and Up

Data Analysis with Team Squirrel - Using Google Sheets

Overview

Students in cooperative teams will use a spreadsheet and graphing program such as Google Sheets or Microsoft Excel to graph and evaluate a large data set. The data sets provided come from authentic arctic ground squirrel research completed at Toolik Research station in arctic Alaska. The data sets were downloaded from body temperature loggers implanted into individual animals to better understand the physiology of hibernation. In this activity, student teams will generate graphs individually or in pairs. With graphs visible for interpretation, teams will compare and contrast male and female body temperature changes through the arctic year. Possible explanations for observations will be discussed within the group and as a class.

Objectives

- Students will practice graphing skills and data analysis with a large data set using graphing software.
- Students will generate graphs showing how arctic ground squirrels are adapted to the extreme cold and darkness of the arctic winter.
- Students will examine a sub-set of the annual data to understand how daily circadian rhythms play a role in summer behavior.
- Students will compare and contrast the characteristics of male vs. female hibernation behavior and develop hypotheses to explain differences.

Lesson Preparation

- This lesson fits well within a biology unit when discussing homeostasis, hibernation, or adapting to the environmental conditions of the earth's biomes.
- Students should be familiar with the process of data

Materials

- Computers with Google Sheets or Excel graphing software for each student or pair of students.
- Internet access to download data sets and view introductory video.

collection from arctic ground squirrels from the PolarTREC archives including journals, and videos. These can be found at: <http://www.polartrec.com/expeditions/arctic-ground-squirrel-studies-2014>

- Advance preparation time needed for this activity will depend on student and instructor familiarity with Google Sheets or Excel.
- If needed, Instructor can demonstrate the following procedure for selecting data, graphing, and then modifying the graph into a final product.



Student Procedure For Google Sheets Files

Google "Sheet" Data Sets for graphing:

<https://drive.google.com/folderview?id=0B-53MhEE53k1SmtHVXVOSUpNbDA&usp=sharing>

1. Break into teams of four. Each member of your "squirrel team" will graph one of the data sets available online.
2. Choose a "Google Sheet" File from the activity folder. This is your individual data set which you will graph and interpret. In the upper right corner is a little box with an arrow labeled "**pop out**". Click this and then Save a copy of the file in your Google drive so that you can edit and work with the data.
3. Highlight the tab above the dependent (body temperature) and independent (date) variables you wish to compare by selecting the column header "A" and "B". Both columns can be selected simultaneously using the **shift key**.
4. With two columns highlighted, generate the graph by selecting **Insert** and **chart** from the menu.
5. Select the **timeline chart** shown or go to **More** and select the **line** chart and click **insert**.
6. With graph visible on your screen, sketch a simple graph with x and y axes on your answer sheet. Be sure to show any noticeable characteristics and the timing.
7. With your group, discuss the notable characteristics of your graph. Explain these in a short descriptive paragraph citing specific data values and the dates when these changes occur. Record your answers on the answer sheet.
8. Compare the data set for a male squirrel and a female. What are the differences? What are the similarities? Compare the data set for a male squirrel and a female. What are the differences? What are the similarities? Record your answers.

9. During the month of August the data is tightly packed and difficult to interpret. To better understand what is happening during this time, examine the data for the month of August only. This can be done using the zoom tool in the upper left corner. Select 1m for one month. Using the scroll bar on the bottom of your graph, highlight the data for August.
10. Describe the August graph using example data. What is the body temperature of the squirrels before entering hibernation?
11. Examine the high points and low points of the graph. Is there any predictable pattern?
12. What is the daily variation in temperature seen in August?
13. In the arctic summer there are 24 hours of daylight and no darkness. What are some of the possible cues that the squirrels could use to set their biological clocks? How might they know what time to be active and when to sleep?
14. The 24 hour cycle of activity shown in the graph is known as a circadian rhythm. Many arctic animals such as caribou and ptarmigan show no circadian rhythm for daily activity. Why might the circadian rhythm seen in ground squirrels be beneficial to them? How could this help their survival?



A hibernating arctic ground squirrel in the lab at the University of Alaska, Fairbanks. This squirrel's body temperature may drop as low as -2.9 C , a record for mammals.



An i-Button body temperature logger. These are surgically implanted under the skin.

Extension

n/a



Resources

- Google "Sheet" Data Sets for graphing
<https://drive.google.com/folderview?id=0B-53MhEE53k1SmtHVXVOSUpNbDA&usp=sharing>
- Andre Wille, 2014. Polar TREC Journals
<http://www.polartrec.com/expeditions/arctic-ground-squirrel-studies-2014>
- Alicia Gillean, 2013. PolarTREC Journals
<http://www.polartrec.com/expeditions/arctic-ground-squirrel-studies>
- Charlie Heck, 2014. National Science Foundation. Live Science Video Series
<http://www.livescience.com/48643-arctic-squirrels-share-circadian-secrets.html>
- Hibernation Phenomenon of Re-Warming Arctic Ground Squirrel with Infrared Camera
<https://www.youtube.com/watch?v=jtWntEffFuk#t=117>
- Cory T. Williams Website, Science Publications, Links to squirrel science sites.
<http://www.corytwilliams.com/publications.html>
- PBS NewsHour. How soil and squirrels offer cues on Alaska climate change.
<http://www.pbs.org/newshour/bb/soil-squirrels-offer-cues-alaska-climate-change/>

Assessment

- Completion of the graphs and the data analysis questions (attached).
- Data based assessment questions from unit exam.
- Student course evaluations describing favorite course units.

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Files Include:

1. Data Analysis with Team Squirrel-Procedure
2. Data Analysis Questions



Standards

Colorado State Science Standards: Life Science

7. Physical and behavioral characteristics of an organism are influenced to varying degrees by heritable genes, many of which encode instructions for the production of proteins

- Explain using examples how genetic mutations can benefit, harm, or have neutral effects on an organism (DOK 1-)

9. Evolution occurs as the heritable characteristics of populations change across generations and can lead populations to become better adapted to their environment

- a. Analyze and interpret data on how evolution can be driven by three key components of natural selection – heritability, genetic variation, and differential survival and reproduction (DOK 1-3)

National Science Education Standards

Content Standards, Grades 9-12

Content Standard A: Science As Inquiry

- a. Abilities necessary to do scientific inquiry
- b. Understandings about scientific inquiry

Content Standard C: Life Science

- c. Biological evolution
- f. Behavior of organisms

Content Standard E: Science and Technology

- a. Abilities of technological design
- b. Understandings about science and technology

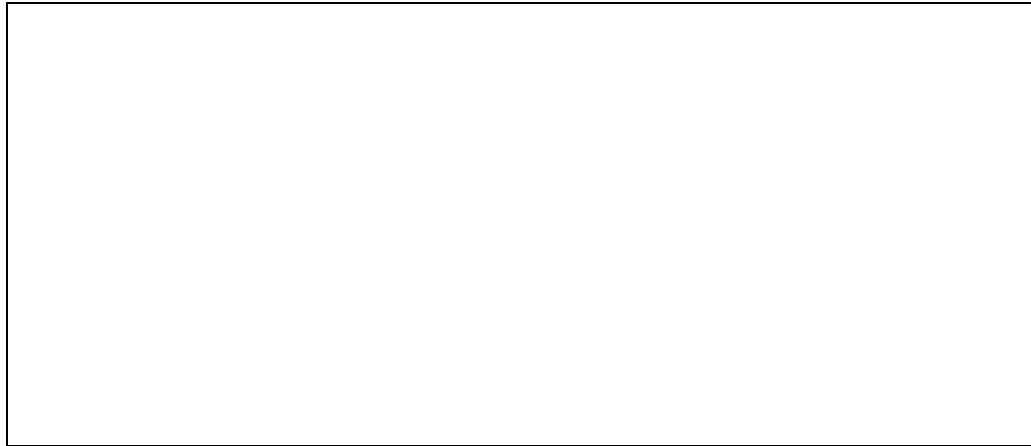
Data Analysis with Team Squirrel-Analysis Questions

Name _____

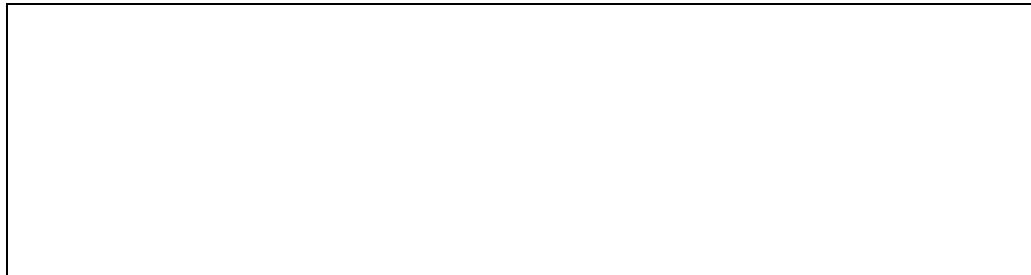
Team Members _____

After each team member generates a graph of one of the data sets, discuss the resulting graphs and complete the following:

1. Sketch of graph showing x and y axes.



1. With your group, discuss the notable characteristics of your graph. Explain these in a short descriptive paragraph citing specific data values and the dates when these changes occur.
2. Compare the data set for a male squirrel and a female. What are the differences? What are the similarities?
3. Using the August data only, examine the high points and low points of the graph. Is there any predictable pattern? How often do they peak?



Sketch a segment of the August graph with one day increments on the x axis.

4. What is the daily fluctuation in body temperature?

5. In the arctic summer there are 24 hours of daylight and no darkness. What are some of the possible cues that the squirrels could use to set their biological clocks? How might they know what time to be active and when to sleep?

6. The 24 hour cycle of activity shown in the graph is known as a circadian rhythm. Many arctic animals such as caribou and ptarmigan show no circadian rhythm for daily activity. Why might the circadian rhythm seen in ground squirrels be beneficial to them? How could this help their survival?