



Ladies and Gentlemen, Boys and Girls

Created by the NC Aquarium at Fort Fisher Education Section

Essential Question:

How is the gender of sea turtle eggs determined?

Lesson Overview:

Students will learn that gender in sea turtles is determined by the temperature of the eggs by designing an experiment to test the temperature of different colored sand. They will then graph those temperatures and calculate how many male and female sea turtles would have hatched in those temperatures.

Learning Objectives:

Students will be able to:

- Design an experiment to test the temperature of different colored sand.
- Use thermometers and/or probe-ware to read and record temperatures of sand.
- Graph changes in temperature over time.
- Calculate the number of expected male and female hatchlings based on the temperature of the sand surrounding the nest.

NC Standards:

Second Grade:

Science:

- **2.L.1** Understand animal life cycles.
 - **2.L.1.1** Summarize the life cycle of animals:
 - Birth
 - Developing into an adult
 - Reproducing
 - Aging and death

Third Grade:

Science:

- **3.P.3** Recognize how energy can be transferred from one object to another.
 - **3.P.3.2** Recognize that energy can be transferred from a warmer object to a cooler one by contact or at a distance and the cooler object gets warmer.

Fourth Grade:

Science:

- **4.L.1** Understand the effects of environmental changes, adaptations and behaviors that enable animals (including humans) to survive in changing habitats.
 - **4.L.1.1** Give examples of changes in an organism's environment that are beneficial to it and some that are harmful.



Fifth Grade:

Science:

- **5.P.3** Explain how the properties of some materials change as a result of heating and cooling.
 - **5.P.3.1** Explain the effects of the transfer of heat (either by direct contact or at a distance) that occurs between objects at different temperatures.
- **5.L.2** Understand the interdependence of plants and animals with their ecosystem.
 - **5.L.2.3** Infer the effects that may result from the interconnected relationship of plants and animals to their ecosystem

Time Frame:

Preparation: 5 minutes

Activity: 30 minutes plus time for the experiment

Discussion: 10 minutes

Materials:

- Sand (at least 3 different colors, including a very light and a dark sand)
- Clear cups
- Lamp or other heat source
- Thermometers or probeware (if available)
- Designing an Experiment and How Science Works worksheets (one per student)

Supplemental Background Information for Teachers:

Sea Turtles, like other reptiles, lay eggs. Because reptile eggs cannot stay submerged, sea turtles must come onto the beach to lay their eggs. The female turtle will dig a hole about 18 inches deep and deposit about 85-150 eggs. As the eggs incubate, the temperature of the sand around their nest determines the gender of the hatchlings. Warmer sand produces more or all female hatchlings, whereas cooler sand produces all or more male hatchlings. For North Carolina loggerheads, sand that is 28°C or less will be mostly males, while sand warmer than 30.5°C will be mostly females. Sand that is between those two temperatures will have a mixture of male and female hatchlings (Girondot 1999).

Preparation:

Make copies as needed and familiarize yourself with the vocabulary and protocols in the Designing an Experiment worksheet.



Procedure:

1. As a class, review the different parts of a scientific experiment, including independent variable (the thing you change), dependent variable (the thing you are measuring), constants (the things you are keeping the same) and controls (the group separated where you do not change the independent variable).
2. Give students background information on sea turtle nests and eggs if they are not already familiar with them. We suggest “You make the Crawl” or “Nest Observation and Relocation”.
3. Ask your students questions to see if they know anything about gender in sea turtles. Sea turtle gender is determined by the temperature in which their eggs develop. Sea turtles end up as hot chicks and cool dudes.
4. Ask students what might play a role in what temperature the eggs are developing? Some answers should include: outside temperature, sun/shade, time of year, location of the nest, color of the sand, etc.
5. Have students complete the Design an Experiment worksheet and carry out their experiments testing the sand temperature.
6. Have students create a number line from their lowest observed temperature to their highest observed temperature. Plot the data on the number line. If none of your data falls within the male / female temperature range of 28-30.5°C, you can make up additional data points for your students.
7. Have the students circle the data points for the nests that would produce boys and put a square around the nests that would produce girls. If it would produce both males and females, have them put both a circle and square around the data point.

Extensions:

1. Research sand from around the world. Find some places with interesting colored beach sand and tell us how that might affect the temperature of the sand.
2. Beach renourishment is a common solution to runoff in North Carolina. As a class, research the issues associated with beach renourishment and sea turtle nesting. For example sand brought in for renourishment is often darker than the beach sand. How would this impact the eggs?
3. Redo the experiment but have the students set the sand and thermometers up in a window. Record the temperature once a day for several weeks. Graph the temperatures. The gender is determined by the temperature of the nest in the middle of the 60 day incubation cycle. How would this change their results?



Vocabulary List

Independent Variable: The part of the experiment controlled or changed by the experimenter.

Dependent Variable: The part of the experiment that changes because of the independent variable. You observe or measure this part to collect data.

Constant: Part of the experiment that remains the same throughout to prevent it from affecting the outcome.

Control: Standard of comparison, in the “natural” state.

Hypothesis: Educated guess or prediction.

Qualitative Observation: Use words to describe something’s appearance, such as color or texture.

Quantitative Observation: Use numbers to describe information about an object such as mass, length, or volume.

Question: You are trying to answer this with your experiment.

Resources:

Girondot, M. (1999). Statistical description of temperature-dependent sex determination using maximum likelihood. *Evol. Ecol. Res.* 1, 479-486.