



Wildlife Lesson/Activity

Carapace Capers: Measure and Analyze Box Turtle Shells

Content Area	Math & Science
Audience	Grades 5-8
Setting	Classroom, school grounds (optional)
Duration	30-90 minutes based on number of activities completed; three activities are included
Objectives	<p>Students will:</p> <ol style="list-style-type: none"> 1. Demonstrate proper measuring and recording of box turtle carapace (top shell of turtle) 2. Graphically illustrate and analyze their box turtle data. 3. Use ratios to compare male and female box turtle measurement data. <p>Students participating in the Plot Creation module will:</p> <ol style="list-style-type: none"> 4. Explain how sub-plots are created at a Box Turtle study site. 5. Demonstrate how sub-plots are surveyed at a Box Turtle study site.
Key Terms	carapace, plastron, ratio, measurements, data, Eastern Box Turtles, graphing
Materials	Box Turtle carapace images (provided), real Turtle shells (optional), metric rulers, graph paper, Google Earth. For Outdoor activity: laminated Box Turtle shells or purchase fake turtles or skulls or tracks
NC SCOS	NC.5.NBT.6, NC.5.NF.3, NC.5. g.1 NC.6.RP.1, NC.6.RP.3, NC.6. SP.1
Correlations	NC.7.RP.1, NC7.RP.2, NC.7. SP.3 NC.8. SP.1, NC.8. SP.2

Overview:

Using photographs of Eastern Box Turtles students collect data related to turtles like wildlife biologists collect during field studies. Students graph their data and use ratios to analyze their data. If time and campus site permit students set up study plots on their own school campus. Three activities are included in this lesson/activity plan.

Background:

The Eastern Box Turtle (*Terrapene carolina carolina*), the state reptile of North Carolina, is the subject of an ongoing 100 year study, called the [Box Turtle Connection](#). The purpose of this long-term project is to learn more about the status and trends in Box Turtle populations across NC to identify threats and develop strategies for long-term conservation of the species. The following activities are designed to give students a better understanding of how wildlife biologists collect and analyze data and set up field study sites.

Measuring Box Turtle Carapace – video on the how to measure the shell (add video link)

Gems of the Forest: Eastern Box Turtles video (add video link)

Introduction:

Questions to ask students before or after watching Box Turtle video:

1. If you could choose, which native NC animal would you pick to study? Why?
2. What are some things you would want to learn about the animal?
3. How could you use math to help you study the animal?

Watch “Gems of the Forest: Eastern Box Turtles”

Activity 1: Box Turtle Measurements

In this activity, like wildlife biologists in the field, students measure and record carapace (top shell) length and width.

1. Use projector and scroll through all the box turtle carapace shells in the Box Turtle Carapace Photos file.
Query students: How are male/female shells the same? Visually do you notice any differences?
What questions could be asked that using math could answer?
2. Distribute carapace photos. Or if you have enough real box turtle shells (at least 5 male & at least 5 female) these could be used in place of the photos.
3. View “Measuring Turtle Carapace” video or demonstrate how to properly measure a turtle’s carapace.
4. Students measure their turtle carapace length and width and record their data on a white board or Google sheet. Keep male and female data separated. Measurements are rounded to match the precision expectations for each specific grade level, but measurements to the nearest whole millimeter are recommended
5. Query students – Are all shell sizes the same? Why do Box Turtles have different shell sizes?
Grade 6: Propose a statistical question that can be answered by these data. Example, how long are the box turtle shells?
6. Graph the measurement data in scatter plot form, plotting values for carapace length on the x-axis, and values for carapace width on the y-axis. Graph the data points from male and female turtles in different colors
7. Instructor also graphs the data, so the students have something to compare their work to
8. Share any trends observed in the data. Overall trend that should be seen: as turtle carapace length increases, so does carapace width.
9. Some analysis and discussion questions:

Why does it make sense that turtle carapace length and width are directly related?

Do you notice anything different in the trends of carapace length and width in male vs female turtles?

What other data could you collect from a box turtle carapace or box turtle shell?

For **Grade 8**: *Does the scatter plot have a linear association?*

Mark the outlying data points and clusters.

Additional for Grade 5:

10. Revisit the table with the raw data
11. Students write each data point as a fraction
12. Divide numerator by denominator

What information does the above provide? Shows the relationship between turtle length and width

Which operation does ‘write the number’ as a fraction represent? Division

What else could we do to the data to find out more?

Additional for grades 6-8:

13. Revisit the table with the raw data
14. Create ratios for each data point that describe the relationship between carapace length and width (width: length)
15. Compare the average carapace width: length ratio for females to the same ratio for males.

How do the ratios for male and female turtles compare?

What might explain their differences? hint: who carries and lays the eggs?

What other questions could be asked and answered using the data from the tables?

Note: *Unlike male turtles, female turtles carry eggs before they are laid in a nest. How could differences in shell ratio be explained based on this female function? Possible answers: females need more room for the eggs and having a wider shell may allow for that. If you have real turtle shells students could measure the height of the carapace at the widest width and compare female to male measurements.*

Activity 2: Study Site Design Using Google Earth

At study sites in the Box Turtle Connection project and for other wildlife studies, wildlife biologists, field technicians and/or volunteers are tasked with surveying large tracts of forest in a short period of time. To survey all that land, the study site is divided into sub-plots. Sub-plots are randomly selected, surveyed, and survey results are recorded.

Getting started questions:

What other problems may arise when surveying large tracts of land?

What would you do or use to survey lots of land?

1. Use Google Earth to provide an image of your school's campus. Include as much of the school property as possible, especially fields and wooded areas
2. Give each student or group a copy of the campus picture
3. The map should have a clear scale in one of the corners
4. Mark out the developed sections of the school's property: school buildings, parking lots and driveways. They will not be used in sub-plot creation. *Why not?*
5. Divide the remainder of the school property (the natural or non-developed area), into as many 50m x 50m square plots as possible using a ruler and starting from a corner of the school property
6. Add any leftover areas and irregular corners in the nearest square plot, making sure that no plot is larger than 100m on one side
7. Compare maps
8. Poll the class to find the most common map layout
9. Make the most common layout into a master copy and post it to the classroom
10. Number the sub-plots on the master copy, with the northwestern-most sub-plot as number one
11. Students count off, and calculate the area and perimeter of whichever sub-plot corresponds to the number they were assigned
12. Use a random number generator to select one of the sub-plots. The selected sub-plot will be used in Activity 3
13. Discussion questions:
 - How could we use the map?*
 - Is there an optimal way to make the map?*
 - If so, how would it be done, and what would make it optimal?*

Activity 3: Survey a School Plot

To determine what areas of the forest to survey, wildlife biologists randomly select sub-plots using a random number generator. To survey a subplot the biologist line up at one corner of the plot and walk ahead to the next corner with each person walking at the same speed and looking for the animal who is the subject of the survey. At end of the plot they move leapfrog fashion, turn around and walk to the opposite side, turn again and walk to opposite side, and continue in this manner until the whole plot is surveyed. See diagram at end of this section.

Question to get started:

How would you survey a sub-plot?

1. Before class, use the map or a GPS to find the sub-plot and mark its boundary on all sides.
2. Before class instructor places real or fake turtle shells, animal skulls, or other animal parts in the selected sub-plot from Activity 2. This guarantees students find some 'animals'.
3. Prepare students to walk outside and find study plot. Students use map or GPS to find the subplot.
4. To survey the sub-plot, students line up at a corner along one side of the sub-plot about an arms-length apart and walk slowly at same rate across the sub-plot, looking for box turtles or other animals (see diagram below)

